Army Test Resources Master Plan (ATRMP)

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Foreword

During these times of fiscal constraint and changing roles and missions, it is necessary that the Army Test and Evaluation community have one document that cogently explains our work of today and our vision for the future. The Army Test Resources Master Plan (ATRMP) is that document.

The capabilities and equipment we have today are, in the main, the result of decisions made a decade or more ago. As we help the Army prepare for the 21st Century, the decisions we make today will determine the infrastructure needed to test and field the Army of the future. This presents both an opportunity and a challenge. We have developed the ATRMP to make the best use of our scarce resources to test, analyze, and evaluate the Force for the future, while still meeting today's needs. The ATRMP is based on a time-phased investment strategy and is linked to and supportive of the Army"s Modernization Strategy. We believe that the plan is prudent and sets a course for future change.

Through proper planning, we can continue to provide the Army efficient and reliable tests, evaluations, and analyses to support the Acquisition process for the Army of the Future.

Coordination by:

Larry J. Dodgen
Lieutenant General, USA
CG, SMDC

James R. Myles
Brigadier General(P), USA
CG, ATEC

Roger A. Nadeau
Brigadier General, USA
CG, USARDECOM

for Stephen M. Seay
Brigadier General, USA
PEO, STRI

Approved by:

Walter W. Hollis
Deputy Under Secretary of the Army
(Operations Research)

Executed by:

Dr. John B. Foulkes
Director, Test and Evaluation
Management Agency

12/17/2004

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ARMY TEST RESOURCES MASTER PLAN (ATRMP)

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Army Test Resources Master Plan (ATRMP)

Chapter I. Introduction

A. Purpose

The Army Test Resources Master Plan (ATRMP) outlines a comprehensive investment program that will guarantee our Soldiers are equipped with the best engineered, analyzed, tested, and evaluated systems available. It provides a vital link between top-level Army strategy and planning guidance (e.g., the Chief of Staff of the Army's (CSA) Rapid Equipping Force (REF) initiative and the emerging plan to spiral fielded REF systems to the rest of the Army) and the Test and Evaluation (T&E) community. It also provides general guidance to the Army T&E organizations regarding T&E investments in support of the Army budgetary process. This guidance will allow the T&E community to properly focus its investments to sustain and modernize its infrastructure consistent with the Army T&E goals and objectives, as well as the Army Vision.

The Army T&E infrastructure must be capable of conducting adequate, realistic, and timely test and evaluation in a joint environment to enable informed decisions regarding development, acquisition, and deployment of the Army of the future as part of the joint force. Prudent and timely planning is required to ensure that the proper people, management, ranges, and equipment are in place to accomplish this mission. Poorly planned investments could result in test equipment that is outdated, a workforce that is not sufficiently available or trained, ranges and facilities that are unable to support required test operations, and a management structure incapable of meeting the demands placed upon it. The establishment of priorities, keyed to the Army's requirements, will allow the T&E community to efficiently invest its scarce resources.

As the Army upgrades current systems and develops new technology to support the future Army, the T&E community must stay one step ahead. The technologies being introduced into the force require innovative, and often more complex, technologies to test, analyze, and evaluate them. The T&E community must foresee the technological demands and develop or procure the equipment, infrastructure, and people necessary to address them. To that end, the objective is to shape an Army T&E program that directly supports the Army Vision, Modernization Strategy and Plan, and the Army's Science and Technology (S&T) program.

The ATRMP provides a roadmap for Army T&E and develops the T&E investment strategy by:

- **Supporting the Army Vision, Modernization Strategy, Modernization Plan, and Science and Technology program.**
- **Determining and prioritizing required investments in the Army T&E infrastructure.**
- **Identifying and prioritizing technology and management initiatives and,**
- **Identifying and prioritizing significant investment shortfalls.**

The ATRMP establishes the T&E vision and objectives needed to properly align T&E investments with Army guidance.

B. The Army Vision

The Army's vision for Transformation is best illustrated in figure 1.1, as contained in the Army Strategic Planning Guidance.

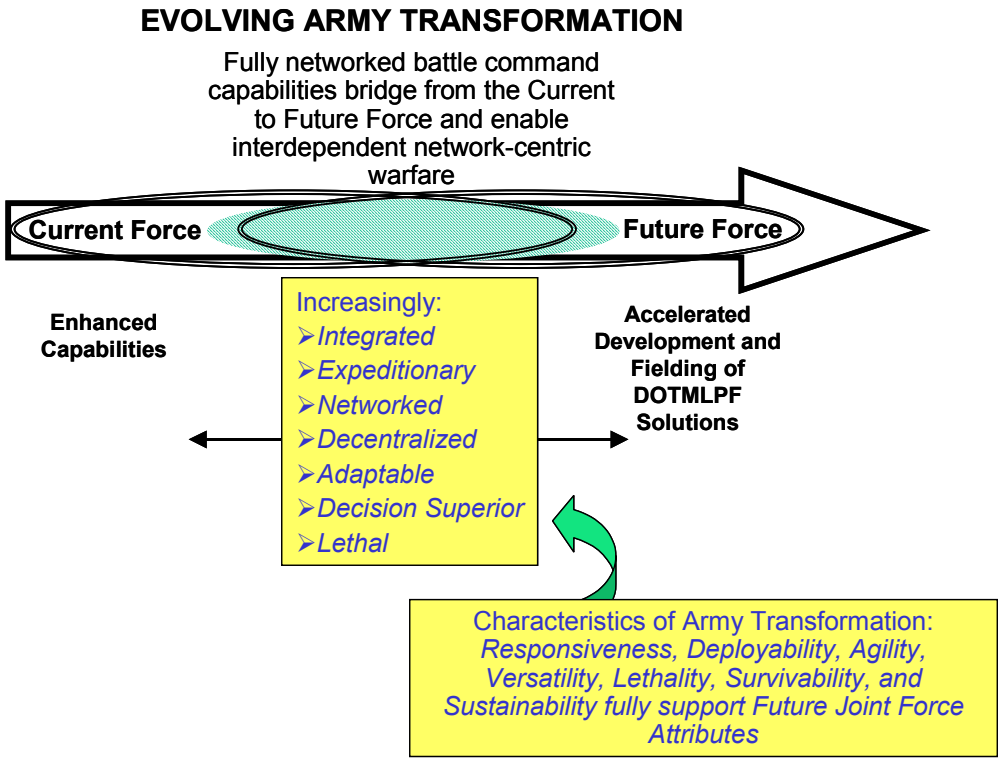

Figure 1-1. Army Transformation

Part of the Chief of Staff's Vision for the Army includes developing a more relevant and ready Army as expressed below:

"Toward a More Relevant and Ready Army

To focus our efforts in increasing the relevance and readiness of our operating and institutional forces, the Army has two core competencies supported by a set of essential and enduring capabilities.

The Army's core competencies are: (1) train and equip Soldiers and grow leaders; and (2) provide relevant and ready land power capability to the Combatant Commanders as part of the Joint Team.

To further concentrate effort, the Army's senior leadership has established immediate focus areas with specific guidance for planning, preparation, and execution of actions aimed at rapidly effecting necessary and positive change. These constitute changes to existing near- and mid-term guidance and are not, nor are they intended to be, all-inclusive.

The Army will reorganize its combat and institutional organizations to best meet the needs and requirements of operating in the current and projected security environment. We must assume sustained operations will be the norm, and not the exception. As we continue the process of transforming our Army while at war, we will redesign our formations to provide modular, capabilities-based organizations, increasing their relevance and responsiveness to the Combatant Commanders. We will develop in our leaders, Soldiers, and Department of the Army (DA) civilians, an unprecedented level of adaptability. We must have balance in our forces, with the ability to operate decisively in an uncertain environment against an unpredictable threat that will make every attempt to avoid our strengths.

Similarly, we will re-examine our doctrine, processes, education, training methodology, and systems to develop and institutionalize a Joint and Expeditionary Mindset. As we seek to resolve the issues associated with transforming our Army for the current and future security environment, we must not allow solutions to be constrained by processes, policies, and systems designed for a world-system that no longer exists. Processes and policies can and will change. Systems must adapt to the needs of the Soldier, our Nation, and the Joint Force."

In support of the Army Vision, one of the Army's core competencies is to train and equip the Soldiers. The Army Modernization Strategy provides the means through which this may be achieved.

C. Army Modernization Strategy

The Army Modernization Plan states "Modernization is a continuous process of integrating new Doctrine, Organizations, Training, Materiel, Leadership and Education, Personnel, and Facilities (DOTMLPF) to develop and field warfighting capabilities for the Army to provide to the Joint Force in executing the National Security and Defense Strategies and all assigned missions." The Army modernization strategy accommodates DoD transformation planning guidance, which describes transformation as "a process that shapes the changing nature of military competition and cooperation through new combinations of concepts, capabilities, people and organizations that exploit our nation's advantages and protect against our asymmetric vulnerabilities to sustain our strategic position, which helps underpin peace and stability in the world". The Army is committed to fulfilling this guidance in its transformational efforts to achieve the desired outcome of realizing fundamentally joint, network-centric, distributed forces capable of rapid decision superiority and massed effects across the battlespace.

The overall Army modernization strategy remains focused on providing the greatest capability possible for the Current Force which remains the foundation of the Army's readiness to fulfill its enduring and nonnegotiable contract with the American people – to fight and win the Nation's wars. At the same time it supports a transformation process to ensure that those capabilities essential for the Future Force are being developed.

1. Future Force

The Army is developing a Future Force that will achieve the capabilities necessary to be a strategically responsive, precision maneuver force that is dominant across the range of military operations. It will be equipped with significantly enhanced systems centered on the Future Combat Systems (FCS), the networked system of systems made up of a family of manned and unmanned air and ground platforms and ground-based maneuver, maneuver support and maneuver sustainment systems. Key enabling systems such as the Warfighter Information Network-Tactical (WIN-T), the Joint Tactical Radio System (JTRS), Distributed Common Ground Sensor – Army (DCGS-A), and the Aerial Common Sensor (ACS) will also complement the overall capabilities that the Future Force will bring to the Joint Force. In order to facilitate the transformation of the Current Force to the Future Force, it is expected that emerging capabilities from the Future Force programs will be inserted into selected components of the Current Force, thus providing force modernization with minimum impact on operational readiness.

2. Current Force

The Current Force includes the existing heavy divisions, light divisions, Stryker Brigades, and Special Operations Forces. It is the guarantor of both

current warfighting readiness and the Army's ability to continue transforming towards the Future Force. The Stryker Brigades or SBCTs are a new component of the Current Force. An operational SBCT deployed to Iraq in the fall of 2003.

3. Rapid Equipping Force (REF)

We are an Army engaged in a global war on terrorism (GWoT), against a foe who quickly adapts his tactics, techniques, and procedures (TTP) to asymmetrically fight our Joint, Interagency, and Multi-National (JIM) forces. In order to ensure our Soldiers are provided with the equipment necessary to dominate this threat, the CSA has initiated:

- A REF program which seeks to field needed capabilities to our forces in Iraq and Afghanistan (as well as those forces preparing to deploy) in 90 days or less, and

- a plan to spiral (in 90 day to 2 years) select, fielded REF systems to the rest of the Army.

4. Balanced Modernization

To support the goal of maintaining and enhancing current capabilities while transforming the Army into a more responsive and capable force for the future, the Army has developed a strategy best described as one of "**balanced modernization**". This strategy seeks to develop and field combat-capable units through an appropriate mix of selective procurement and fielding of new equipment (**modernization**), rebuilding and upgrading of key existing equipment (**recapitalization**), and preserving needed elements of current equipment (**maintenance**).

Maintaining and enhancing essential warfighting capabilities of the Current Force includes the fielding of immediate operational capabilities by organizing and equipping six Stryker Brigade Combat Teams (SBCT); restoring and improving the readiness of units returning from operations through a comprehensive reset effort; and restructuring the Army to create modular units. Another critical element will be an accelerated effort to insert, where feasible, newly developed capabilities into the current force derived from emerging technologies.

The modernization strategy also consists of S&T efforts to enable timely fielding of the Future Force and, in particular, the Future Combat Systems (FCS) which will be the foundation of that force. This entails a corollary mission to identify and field selected new capabilities into Current Force units where appropriate and affordable.

The requirement for this careful balancing means that the Army must continually reassess its plans and programs in light of both the changing strategic environment and the technological opportunities that will continue to evolve over time. Our transformational efforts must retain the best of current capabilities and

take advantage of emerging transformational opportunities to modernize and improve the Current Force while developing more revolutionary initiatives for the Future Force.

5. Operating in a Joint Environment

Within the expected future operational environment and in support of the nation's National Security and Defense Strategies, the Army remains the primary provider of sustained land power forces to the Joint Forces Commander (JFC). The vast majority of missions will be joint in nature, and the full array of Army forces must be structured, equipped, tested, and trained to operate in the joint environment.

For the Joint Force to operate in a simultaneous and distributed manner and accomplish its missions, it requires certain functions, called functional concepts. These joint functional concepts describe how a future JFC will integrate a set of military tasks to attain the capabilities needed to achieve his goal of full-spectrum dominance. These functional concepts are described below:

- **Force Application.** Force Application is the sum of all actions taken to cause a desired effect on our adversary. It encompasses all aspects of fires and maneuvers that suppress, neutralize, seize or destroy an objective, and is enabled by offensive information operations (IO).
- **Protection.** Protection is the sum of all actions taken to prevent an adversary's effect on the Joint Force and the population that the Joint Force protects. These actions include protection of personnel, infrastructure and critical computer networks.
- **Focused Logistics.** Focused Logistics is the ability to sustain the Joint Force with the right personnel, equipment, supplies, and support in the right place at the right time, and in the right quantities. Key support functions include deployment, distribution, global mobility and the ability to provide medical support to combat forces.
- **Battlespace Awareness.** Battlespace Awareness (BA) is the ability to sense and understand the operational environment with its mix of friendly "blue" forces, enemy "red" forces, and "gray" non-aligned noncombatants as well as terrain and weather aspects that can aid or hinder friendly force operations. BA relies upon the continuous collection, processing, analysis and modeling of data from a large mix of highly responsive sensors (e.g., unattended, human, intrusive and remote) to provide the commander with real-time, collaborated, tailored, actionable battlespace information.
- **Command and Control.** Command and Control (C2) is the exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Key elements of C2 are a decentralized, networked and collaborative communications and computer environment and the precision guidance

and timing capabilities that collectively support accelerated decision-making processes throughout the Joint Force.

The Army's materiel development efforts will be tied to these concepts for fielding the Joint Force with its integrated capabilities. Annex D to the 2004 Army Modernization Plan categorizes key materiel development efforts in terms of the above functional concepts and is reflected in the following weapon system matrix.

	Joint Functional Concepts and Weapon System Matrix	**Force Application**	**Protection**	**Focused Logistics**	**Battlespace Awareness**	**Command and Control**
	FUTURE FORCE SYSTEMS					
	Advanced Precision Kill Weapon System (APKWS)	■				
	Aerial Common Sensor (ACS)				■	
	Compact Kinetic Energy Missile (CKEM) ATD	■				
	Distributed Common Ground System - Army (DCGS-A)				■	
	Enhanced Area Air Defense System (EAADS)		■			
	Future Combat Systems (FCS)	■				
	Future Tactical Truck System (FTTS)			■		
	Future Force Warrior ATD	■				
	Ground-based Mid-course Missile Defense (GMD)		■			
	Integrated Airburst Weapon System (XM29 Rifle)	■				
	Joint Common Missile	■				
	Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS)		■			
	Joint Service Sensitive Equipment Decontamination (JSSED)		■			
	Mid-range Munition (MRM) KE/CE ATD	■				
	Mobile Tactical High Energy Laser (MTHEL)		■			
	Multi-Functional On-the-Move Secure Adaptive Integrated Communications (MOSAIC) ATD					■
	Networked Sensors for the Future Force ATD		■			
	Non-Line-of-Sight (NLOS) Cannon	■				
	Non-Line-of-Sight Launcher System (NLOS-LS)	■				
	Objective Crew Served Weapon (OCSW) XM307	■				
	Precision, Extended Glide Airdrop System (PEGASYS) ACTD			■		
	Theater High Altitude Area Defense (THAAD)		■			

	Joint Functional Concepts and Weapon System Matrix	Force Application	Protection	Focused Logistics	Battlespace Awareness	Command and Control
	Warfighter Information Network - Tactical (WIN-T)					■
	CURRENT FORCE SYSTEMS					
	Abrams upgrades **RECAP**	■				
	Advanced Field Artillery Tactical Data System (AFATDS)				■	
	Advanced Threat Infrared Countermeasures (ATIRCM)	■				
	Advanced Medium Mobile Power Source (AMMPS)			■		
	Air and Missile Defense Command & Control System (AMDCCS)					■
	Air Traffic Navigation, Integration, and Coordination System (ATNAVICS)	■				
	Air Warrior	■				
	All Source Analysis System (ASAS)				■	
	Apache (AH-64) **RECAP**	■				
	Army Airborne Command and Control System (A2C2S)	■				
	Army Battle Command System (ABCS)					■
	Army Common User System (ACUS)					■
	Army Tactical Missile System (ATACMS)	■				
	Authorized Stockage List Mobility System (ASLMS)			■		
	Biological Integrated Detection System (BIDS)		■			
	Blackhawk (UH-60) **RECAP**	■				
	Bradley Fighting Vehicle **RECAP**	■				
	C-12	■				
	C-23	■				
	Chemical Biological Protective Shelter (CBPS)		■			
	Chinook (CH-47D) **RECAP**	■				
	Collectively Protected Deployable Medical System (CP DEPMEDS)		■			
	Combat Service Support Automated Information System Interface (CAISI)			■		
	Battle Command Sustainment Support System (BCS3)			■		
	Dry Support Bridge (DSB)			■		
	Enhanced Night Vision Goggles (ENVG)	■				
	Excalibur (XM982 Munition)	■				
	Family of Medium Tactical Vehicles (FMTV)			■		
	Force XXI Battle Command Brigade and Below System (FBCB2)					■
	Forward Repair System (FRS)			■		

	Joint Functional Concepts and Weapon System Matrix	Force Application	Protection	Focused Logistics	Battlespace Awareness	Command and Control
	Global Air Traffic Management (GATM)	■				
	Global Combat Service Support - Army (GCSS-A)			■		
	Global Command & Control System - Army (GCCS-A)					■
	Global Positioning System (GPS)					■
	Grenadier BRAT (GB) / Mini Transmitter (MTX)				■	
	Ground Standoff Minefield Detection System (GSTAMIDS)			■		
	Guided Multiple Launch Rocket System (GMLRS)	■				
	Handheld Standoff Mine Detection System (HSTAMIDS)			■		
	Heavy Expanded Mobility Tactical Truck (HEMTT)			■		
	Hellfire Family of Missiles	■				
	High Mobility Artillery Rocket System (HIMARS)	■				
	High Mobility Multi-purpose Wheeled Vehicle (HMMWV)			■		
	Improved Ribbon Bridge (IRB)			■		
	Improved Data Modem	■				
	Integrated Meteorological System (IMETS)				■	
	Javelin	■				
	Joint Biological Agent Identification and Diagnostic System (JBAIDS)		■			
	Joint Biological Standoff Detection System (JBSDS)		■			
	Joint Chemical Agent Detector (JCAD)		■			
	Joint Chemical Agent Standoff Detection System (Artemis)		■			
	Joint Mission Planning System (JMPS)	■				
	Joint Portal Shield (JPS) Detector System		■			
	Joint Precision Approach Landing System (JPALS)	■				
	Joint Service Family of Decontamination Systems (JSFDS)		■			
	Joint Service General Purpose Mask		■			
	Joint Service Lightweight Integrated Suit Technology (JLIST)		■			
	Joint Service Lightweight NBC Recon System (JSLNBCRS)		■			
	Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD)		■			
	Joint Tactical Ground Station (JTAGS) / Multi-Mission Mobile Processor (M3P)		■			
	Joint Tactical Radio System (JTRS)					■
	Joint Warning & Reporting Network (JWARN)		■			
	Kiowa Warrior (OH-58D)	■				

	Joint Functional Concepts and Weapon System Matrix	Force Application	Protection	Focused Logistics	Battlespace Awareness	Command and Control
	Land Warrior	■				
	Large Improvised Explosive Device (IED) Countermeasures		■			
	Lightweight 155 Howitzer (M777)	■				
	Lightweight Water Purifier (LWP)			■		
	Line-of-Sight Anti-Tank (LOSAT)	■				
	Load Handling System (LHS) Compatible Water Tank Rack System (Hippo)			■		
	Load Handling System Modular Fuel Farm (LMFF)			■		
	Long Range Advanced Scout Surveillance System (LRAS3)				■	
	M56 Wheeled Smoke System (Coyote)		■			
	Maintenance Support Device (MSD)			■		
	Maneuver Control System (MCS)					■
	Man-Transportable Robotic System (MTRS)		■			
	Medical Communications for Combat Casualty Care (MC4)			■		
	Medium Extended Air Defense System (MEADS)		■			
	Mobile Tower System (MOTS)	■				
	Mounted Warrior Soldier Systems (MWSS)	■				
	Movement Tracking System (MTS)			■		
	Non-invasive Filler Identification (NFI) System		■			
	Non-lethal Capabilities Set (NLCS)	■				
	Nuclear, Biological and Chemical Reconnaissance System (NBCRS) M93/M93A1 FOX		■			
	Palletized Load System (PLS)			■		
	Patriot Advanced Capability 3 (PAC3) **RECAP**		■			
	Phoenix satellite terminal					■
	Phoenix Battlefield Sensor System				■	
	Precision Guided Mortar Munition (PGMM) XM395	■				
	Prophet				■	
	Rapid Manufacturing System (RMS)			■		
	Rapidly Emplaced Bridge System (REBS)			■		
	Rough Terrain Container Handler (RTCH)			■		
	Secure Mobile Anti-Jam Reliable Tactical Terminal (SMART-T)					■
	Sentinel		■			

	Joint Functional Concepts and Weapon System Matrix	Force Application	Protection	Focused Logistics	Battlespace Awareness	Command and Control
	Single Channel Ground and Airborne Radio System (SINCGARS)					■
	Sorbent Decontamination System, M100 (SDS)		■			
	Special Electronic Mission Aircraft (SEMA) RC-12 & RC-7	■				
	Stryker Family of Vehicles					
	Mobile Gun System (MGS)	■				
	Infantry Carrier Vehicle (ICV)	■				
	- Reconnaissance Vehicle (RV)	■				
	- Mortar Carrier (MC)	■				
	- Commander Vehicle (CV)	■				
	- Fire Support Vehicle (FSV)	■				
	- Engineer Squad Vehicle (ESV)	■				
	- Medical Evacuation Vehicle (MEV)	■				
	- Antitank Guided Missile Vehicle (ATGM)	■				
	- Nuclear, Biological, & Chemical Recon Vehicle (NBCRV)	■	■			
	Suite of Integrated Infrared Countermeasures (SIIRCM)	■				
	Suite of Integrated Radio Frequency Countermeasures (SIRFC)	■				
	Surface Launched Advanced Medium Range Air-to-Air Missile (SL-AMRAAM)		■			
	Tactical Airspace Integration System (TAIS)	■				
	Tactical Exploitation System (TES)				■	
	Tactical Quiet Generator (TQG)			■		
	Tactical Unmanned Aerial Vehicle (TUAV)				■	
	Theater Support Vessel (TSV)			■		
	Thermal Weapons Sights (TWS)	■				
	TOW 2B ATGM	■				
	Transportation Coordinator's Automated Information for Movement System II (TC-AIMS II)			■		
	Unit Water Pod System (CAMEL)			■		
	Vehicle Obscuration Smoke Systems (M6 an M7)		■			

D. The T&E Mandate

The requirement and need for T & E as an integral part of the acquisition of materiel systems are mandated by law, directives, and regulations. Summaries of the primary mandates are discussed below.

Office of Management and Budget (OMB) Circular A-109, Major System Acquisitions, dated 5 April 1976, established policies to be followed by executive branch agencies in the acquisition of major systems. These policies were designed to assure the effectiveness and efficiency of the process of acquiring major systems. They were based on the general policy that Federal agencies, when acquiring major systems, would do the following: encourage innovation and competition by expressing needs and program objectives in mission terms; allow competitive exploration of alternative system design concepts; communicate with Congress early in the system acquisition process; establish clear lines of authority, responsibility, and accountability for management of programs; utilize appropriate managerial levels in decision making; designate a focal point responsible for integrating and unifying the system acquisition management process; and rely on private industry where appropriate. Specifically, paragraphs 7a & d of the Circular state that "…*Each agency acquiring major systems should: Ensure that each major system: Fulfills a mission need. Operates effectively in its intended environment. Demonstrates a level of performance and reliability that justifies the allocation of the Nation's limited resources for its acquisition and ownership*." *Additionally, each agency should "Provide strong checks and balances by ensuring adequate system test and evaluation. Conduct such tests and evaluation independent, where practicable, of developer and user."*

10 United States Code (USC) Sec. 2399, Operational Test and Evaluation of Defense Acquisition Programs, states that "…a major defense acquisition program may not proceed beyond low-rate initial production until initial operational test and evaluation of the program is completed. Operational testing of a major defense acquisition program may not be conducted until the Director of Operational Test and Evaluation of the Department of Defense approves (in writing) the adequacy of the plans (including the projected level of funding) for operational test and evaluation. The Director shall analyze the results of the operational test and evaluation conducted and prepare a report stating the opinion of the Director as to whether the test and evaluation performed were adequate, and whether the results of such test and evaluation confirm that the items or components actually tested are effective and suitable for combat. A final decision to proceed with a major defense acquisition program beyond low-rate initial production may not be made until the Director has submitted to the Secretary of Defense the report with respect to that program and the congressional defense committees have received that report."

10 USC Sec. 2366, Major Systems and Munitions Programs: Survivability Testing and Lethality Testing Required Before Full-Scale Production, states that *"a covered system, major munitions, a missile program, or a product improvement to a covered system, major munitions, or missile program may not proceed beyond low-rate initial production until realistic survivability or lethality testing is completed and the report required by statute is submitted to the prescribed congressional committees."* Specifically, "The Secretary of Defense shall provide that:

(A) A covered system may not proceed beyond low-rate initial production until realistic survivability testing, or lethality testing in case of a product improvement, of the system is completed and the report of the survivability or lethality testing is submitted to the congressional defense committees; and

(B) A major munitions program or a missile program may not proceed beyond low-rate initial production until realistic lethality testing of the program is completed and the report is submitted to the congressional defense committees."

Department of Defense (DoD) Directive 5000.1, The Defense Acquisition System, dated 12 May 2003, provides management principles and mandatory policies and procedures for managing all DoD acquisition programs. In accordance with (IAW) OMB Circular A-109, it fosters flexibility, responsiveness, innovation, disciplined, streamlined and effective management to acquire quality products that satisfy user needs with measurable improvements to mission capability and operational support, in a timely manner, and at a fair and reasonable price. It states that: *"Test and evaluation shall be integrated throughout the defense acquisition process and structured to provide essential information to decision-makers, assess attainment of technical performance parameters, and determine whether systems are operationally effective, suitable, survivable, and safe for intended use. The conduct of test and evaluation, integrated with modeling and simulation, shall facilitate learning, assess technology maturity and interoperability, facilitate integration into fielded forces, and confirm performance against documented capability needs and adversary capabilities as described in the system threat assessment."*

DoD Instruction 5000.2, Operation of the Defense Acquisition System, dated 12 May 2003, establishes a simplified and flexible management framework for translating mission needs and technology opportunities, based on approved missions needs and requirements, into stable, affordable, and well-managed acquisition programs that include weapon systems and automated information systems (AISs). Consistent with statutory requirements and DoDD 5000.1, it authorizes Milestone Decision Authorities to tailor procedures to achieve cost, schedule, and performance goals. It states that "*The PM, in concert with the user and test and evaluation communities, shall coordinate developmental test and evaluation (DT&E), operational test and evaluation (OT&E), live fire test and evaluation (LFT&E), family-of-systems interoperability testing, information assurance testing, and modeling and simulation (M&S) activities into an efficient continuum, closely integrated with requirements definition and systems design*

and development." The T&E strategy shall provide information about risk and risk mitigation, provide empirical data to validate models and simulations, evaluate technical performance and system maturity, and determine whether systems are operationally effective, suitable, and survivable against the threat detailed in the System Threat Assessment. Adequate time and resources shall be planned to support pre-test predictions and post-test reconciliation of models and test results, for all major test events. The Program Manager (PM), in concert with the user and test communities, shall provide safety releases to the developmental and operational testers prior to any test using personnel. Completed independent initial operational test and evaluation (IOT&E) and completed LFT&E shall support a beyond low-rate initial production (LRIP) decision for acquisition category (ACAT) I and II programs for conventional weapon systems designed for use in combat as required by 10 U.S.C. Sec. 2399 and 2366. LFT&E, as that term is defined in 10 U.S.C. 2366, must be conducted on a covered system, major munition program, missile program, or product improvement to a covered system, major munition program, or missile program before it can proceed beyond LRIP. A covered system is any vehicle, weapon platform, or conventional weapon system that includes features designed to provide some degree of protection to users in combat and that is an ACAT I or II program.

AR 73-1, Test and Evaluation Policy, dated 7 January 2002, implements DoD policies and procedures and specifically prescribes implementing policies and assigns responsibilities for Army test and evaluation activities during the system acquisition processes. It applies to all systems acquired under the auspices of AR 70-1. It implements the Army's continuous evaluation program, defines the role of the independent evaluators, and includes implementing policies for the Test and Evaluation Master Plan (TEMP).

DA Pamphlet 73-1, Test and Evaluation in Support of Systems Acquisition, dated 30 May 2003, provides guidance and procedures to implement test and evaluation policy for materiel and information technology systems as promulgated by AR 73-1. It outlines the basic Army test and evaluation philosophy; general test and evaluation guidance in support of materiel systems acquisition and information technology systems acquisition; test and evaluation guidance in support of system modifications and non-developmental items; the Test and Evaluation Working-level Integrated Product Team; preparation, staffing and approval of the Test and Evaluation Master Plan; detailed guidance on preparation, staffing, and approval of critical operational issues and criteria to include key performance parameters; guidance on the planning, conduct, and reporting of system evaluation; and guidance on the planning, conduct, and reporting of testing (that is, developmental and operational) to include test support packages, test incidents, corrective actions, instrumentation, targets, and threat simulators.

Chapter II. The Army Test Resources Master Plan: Vision and Objectives

The Army Test Resources Master Plan is composed of a vision, objectives, and an investment strategy that supports the acquisition and fielding of Army weapon systems. It is complementary to top-level Army strategy and planning guidance as contained in such documents as the Army Modernization Plan, and the Army Science and Technology Master Plan. The T&E investment strategy contained in Chapter V reflects the linkage between planned investments in the T&E infrastructure, the aforementioned T&E objectives, and Army guidance.

A. Vision - The ATRMP Vision is to:

Shape the Army's T&E infrastructure by investing in capabilities which support the Army of the future, producing accurate, reliable, and cost effective information for use by decision makers at all levels.

B. Objectives

The Army's Modernization Plan serves as a compass that lays out modernization efforts to transform the Army. In support of these efforts, the ATRMP has established derivative T&E infrastructure objectives to identify and focus the T&E investments for the five-year POM period (FY07 – FY11). These objectives are as follows:

- **Maintain a highly skilled, multi-disciplinary professional workforce capable of addressing tomorrow's technology demands.**
- **Develop advanced automated test data collection capabilities, and analytical and evaluation tools and methodologies.**
- **Integrate Modeling and Simulation (M&S) into the T&E process.**
- **Modernize and sustain the core infrastructure and architecture to accommodate new and advanced capabilities developed from emerging technologies.**

Taken together, these objectives provide the groundwork for directing the T&E infrastructure investments, which in turn will shape the infrastructure required to support the testing, analysis, and evaluation of our future weapon systems.

1. Maintain a Highly Skilled, Multi-disciplinary Workforce.

Critical to the ability of the T&E infrastructure to meet the needs of the weapon system customer, are the military, civilian, and contractor personnel who plan, execute, analyze, report, and evaluate the test events during the lifecycle of materiel acquisition. The draw-down in personnel since 1990 has resulted in ever-increasing challenges to retain a sufficient workforce trained in the requisite skills for the T&E mission. Finally, the T&E work environment has become more diverse, dynamic, and fluid as witnessed by the increasing complexity of systems under test, the confluence of technology-driven system-of-systems, and a push toward network-centric approaches of deployment. These new complexities provide an extremely challenging environment for the T&E practitioner. The trend to a smaller T&E workforce is unlikely to be reversed. This underscores the importance of training each individual to the highest possible standards, thereby enabling them to capitalize on the use of new technologies and formulating new and innovative test and evaluation techniques and methods.

2. Develop Advanced, Automated Test Data Collection Capabilities and Analytical and Evaluation Methodologies and Tools.

In order to offset the reduction of personnel, and to provide test data collection and analytical capabilities commensurate with the embodied technologies of the weapon systems under test, investments must be made to develop advanced, automated test instrumentation and data processing tools. We must leverage the use of automated data collection systems and computer technology to decrease our dependence on human data collectors and manual data processing. We must develop more technologically advanced and less manpower-intensive analytical capabilities. The use of embedded or transportable data collection, transference, telemetry, and analytical equipment will permit us to more efficiently process the large volume of data generated in system-of-systems and net-centric testing. Current system performance and effectiveness methodologies and models need to be improved to be able to address the analytical questions that will be posed by Army leadership. Because the effective life of automated information systems is so short, we must continue to keep pace, or face obsolescence and technology overmatch by the systems under test.

3. Integrate M&S Into the T&E Process.

Simulation-Based Acquisition (SBA) is a Department of Defense (DoD) process that recognizes that the development and acquisition of tomorrow's weapon systems must take advantage of modeling and simulation (M&S) techniques and tools. The Army's implementation of SBA is the Simulation and Modeling Acquisition, Requirements, and Training (SMART) philosophy. SMART leverages high speed, high volume computer technology to design, develop, test and field weapons and Command, Control, Communications, Computers and Intelligence (C4I) systems more efficiently and at a lower cost.

T&E is no longer viewed as a serial process of developmental testing, operational testing, and evaluation. These functions relied heavily, if not solely, on field testing, with M&S being used only as an after-thought when time and dollars permitted. In order to reduce the burden and cost of field testing, each weapon system development must have at its disposal a total test environment for which an affordable and viable test strategy can be developed. This test strategy must consist of the right mix of constructive and virtual simulation and live field testing. Consequently, the Army T&E infrastructure must provide a total integrated testing package to the customer. Although constructive and virtual simulation can never completely replace field testing, they can often provide useful information in an affordable manner, especially in cases where field testing is impractical, unreasonable, or unsafe. Investments in synthetic environments, simulators, and stimulators can lead to a seamless constructive and virtual T&E capability, and together with live testing will allow complete and efficient test and evaluation of new weapon systems. The Virtual Proving Ground (VPG) is the embodiment of this new approach to integrated testing, which, together with continued advancements in operational test and evaluation M&S, will provide a total test environment.

4. Modernize and Sustain the Core Infrastructure and Architecture.

Much of our day-to-day and routine range operation capabilities are either outdated or well past their useful life and in need of upgrades. Data transmission protocols, basic test calibration and measurement tools, and commonly used computer and data processing networks provide the “open-the-door” architecture on our test ranges. Without investing in these core capabilities, our new state-of-the-art advanced instrumentation cannot be assimilated into the overall infrastructure. This is particularly true as the T&E community attempts to upgrade infrastructure simultaneously with the leap-ahead technologies being used in development of the Future Force. Upgrades to data exchange networks using such things as the Test and Training Enabling Architecture (TENA) will allow test simulators, stimulators, and models to seamlessly communicate with each other. Such core system upgrades become critical when viewed in terms of Army T&E capability required to evaluate performance and operational effectiveness of network centric weapon systems.

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Chapter III. The T&E Infrastructure

For purposes of the ATRMP, the Army's T&E infrastructure consists of:

The personnel, facilities, ranges, and tools required to perform the T&E mission in support of its customers.

To support the Army's Modernization Plan, investments in the T&E infrastructure are needed to ensure that ranges and evaluation activities are postured to support T&E of funded Stryker and Future Force systems. The U.S. Army Test and Evaluation Command (ATEC), the U.S. Army Space and Missile Defense Command (USASMDC), the Project Manager for Instrumentation, Targets, and Threat Simulators (PM ITTS), the Survivability, Lethality & Analysis Directorate (SLAD), and the Army Materiel Systems Analysis Activity (AMSAA) are the commands and organizations that perform the T&E mission and whose infrastructure must be sustained. The last two organizations are part of the U.S. Army Materiel Command (AMC). The Test and Evaluation Management Agency (TEMA) is the Headquarters, Department of the Army activity, in the Office of the Chief of Staff, responsible for Army T&E policy oversight and for coordinating, presenting, and defending the T&E budget in the Army's Planning, Programming, Budget and Execution System (PPBES). The Director, TEMA, develops and coordinates execution of the ATRMP.

A. ARMY TEST AND EVALUATION COMMAND (ATEC)

ATEC plans, conducts, and integrates developmental testing, independent operational testing, independent evaluations, assessments, and experiments in order to provide essential information to decision makers. The primary ATEC products and services include:

- **Initial Operational Test (IOT)**
- **Customer Test (CT)**
- **Follow-on Operational Test (FOT)**
- **Developmental Test (DT)**
- **Safety Testing**
- **Verification, validation, and accreditation (VV&A) of modeling and simulation and of targets and threat simulators/simulations**
- **Live-fire vulnerability and lethality tests**
- **Joint and multi-Service tests involving Army materiel**
- **Force development tests in support of Army combat development process**
- **Field experiments and technology demonstrations**
- **System Assessment (SA)/System Evaluation Reports (SER)**

ATEC is composed of a headquarters (HQ) and three subordinate commands/center. ATEC HQ is located at Alexandria, VA, and its subordinate organizations are the Developmental Test Command (DTC), the Operational Test Command (OTC), and Army Evaluation Center (AEC), as reflected in Figure 3-1.

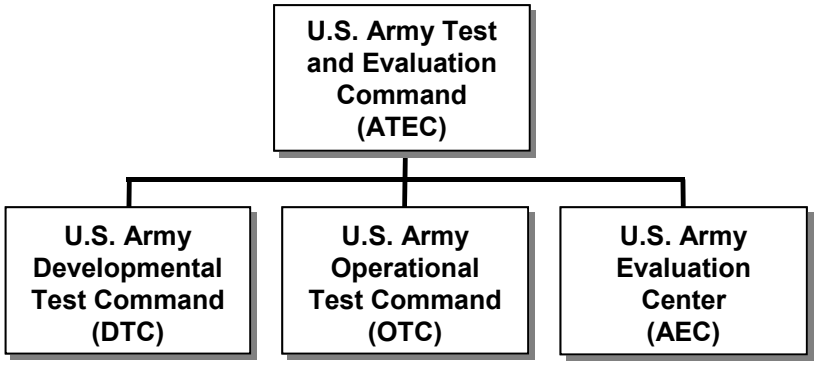


Figure 3-1. ATEC Command Structure

DTC is headquartered at Aberdeen Proving Ground, MD. They provide the developmental test capability for testing DoD materiel, weapons, and weapon systems throughout the acquisition cycle and manage the Army's live fire test mission and ranges.

The Operational Test Command is headquartered at Ft. Hood, TX. The OTC conducts independent operational testing of materiel systems and conducts experiments in support of the Army's Transformation Campaign Plan (TCP) and Advanced Technology Demonstrations/Advanced Concept Technology Demonstrations (ATD/ACTDs). The AEC is headquartered at Alexandria, VA, and is the Army's independent system evaluator.

AEC conducts integrated operational and developmental evaluations, to include congressionally mandated live fire evaluations of materiel systems in support of the Army's acquisition process. AEC also oversees the logistics aspects of acquisition, modification, and deployment of systems.

Figure 3-2 reflects ATEC's test infrastructure and Major Range and Test Facility Base (MRTFB membership (Aberdeen Test Center (ATC), Dugway Proving Ground (DPG), White Sands Missile Range (WSMR), Electronic Proving Ground (EPG), and Yuma Proving Ground (YPG) highlighted in green).

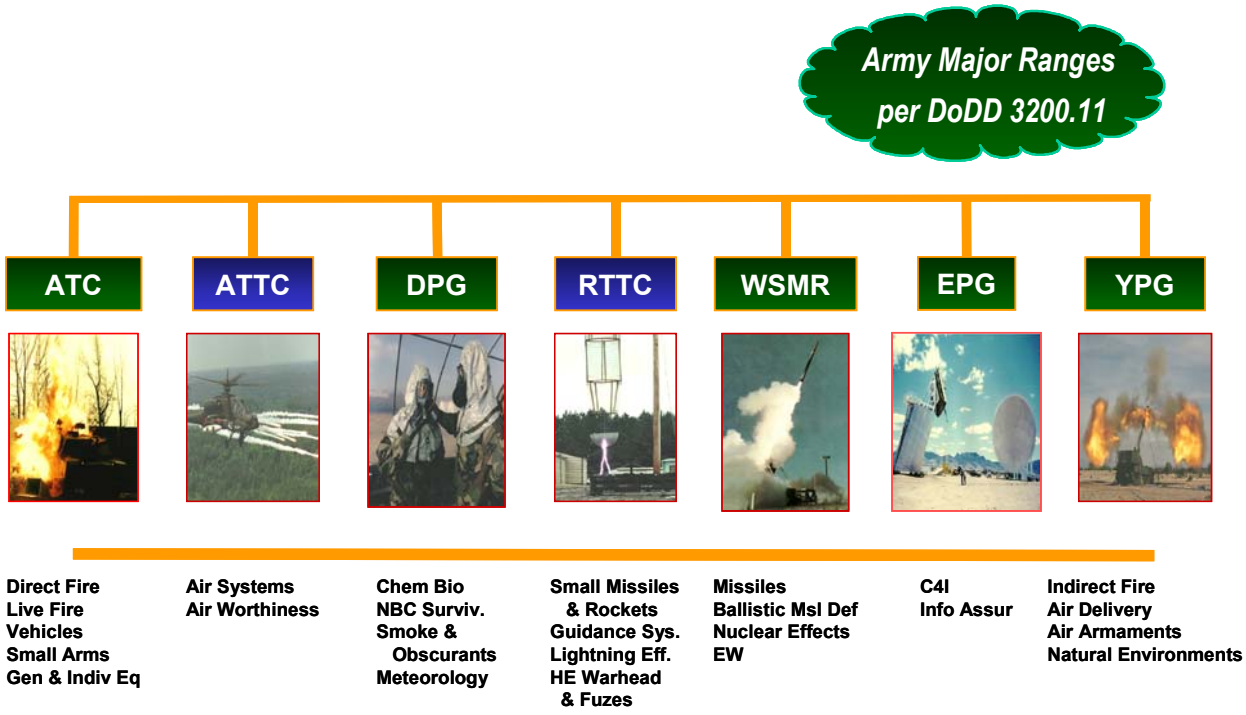


Figure 3-2. Developmental Test Command Test Centers

1. ATEC: DEVELOPMENTAL TEST COMMAND (DTC)

DTC is the developmental test arm of ATEC and the Army's premier materiel developmental testing organization for weapons and equipment. With the largest, most diverse assemblage of testing capabilities in the DoD, DTC tests military hardware of every description across the full spectrum of arctic, tropic, desert and other natural or controlled environments on highly instrumented ranges and test courses. DTC offers a full range of test services, including technical feasibility of early concepts, determining system performance and safety, assessing technical risks during system development, confirming designs, and validating manufacturers' facilities and processes at both system and component levels. Its testing services are extended to all of DoD, other federal agencies, state and local governments, foreign and allied governments, and private industry. Acquisition programs are supported through efficient and cost effective test planning, including streamlining the test program when feasible. DTC works closely not only with Army program managers and the acquisition community, but also with the T&E communities of the Air Force and the Navy. The efficiency and effectiveness of the DoD T&E infrastructure are continuously monitored and improved/updated through the tri-Service T&E Executive Agent structure and process. Within that structure, DTC is the Army member of the Test Resource Advisory Group (TRAG). The TRAG works to oversee the T&E infrastructure, to identify requirements for new capabilities, and to ensure that

investments are not made in unnecessary, duplicative capabilities/facilities. Much of this work is performed through the application of the principles of T&E Reliance. Reliance is that process by which the Services rely on each other's T&E capabilities to meet T&E requirements, where it is practical to do so. Reliance also enables the Services' T&E communities to identify those proposed investments that may be duplicative so that unwarranted duplication of investments or capabilities does not occur. As an active member of integrated product teams (IPTs) that include testers and evaluators, as well as program managers and executive officers, DTC supports the development of the acquisition strategy, statement of work, performance specification, and test/simulation execution strategy. In addition to conducting rigorous performance tests on weapon systems and materiel, DTC tests equipment and systems under a variety of conditions and possible uses to ensure the safety of Soldiers and operators. Test personnel report safety risks, and in some cases, recommend use restrictions that enhance safety. Validating the safety of systems and equipment is the key thrust of DTC's safety verification program, and it is a critical part of the DTC test mission. DTC developed the unique modeling and simulation initiative known as the Virtual Proving Ground (VPG). VPG improves testing and support acquisition from proof of concept and requirements definition to training and doctrine. DTC is headquartered at the Aberdeen Proving Ground, MD and executes its test mission at a variety of test ranges discussed in more detail in subsequent paragraphs. Its command structure is depicted in Figure 3-3.

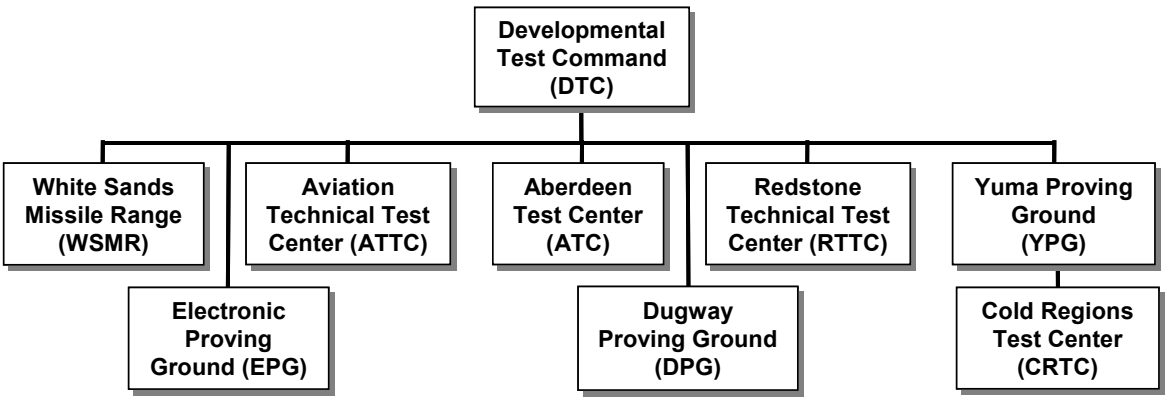


Figure 3-3. DTC Command Structure

a. Aberdeen Test Center (ATC). Aberdeen Test Center is situated at Aberdeen Proving Ground in Central Maryland and is the T&E Reliance lead test agency for land combat, direct fire, and Congressionally-mandated live fire testing. A diverse, multi-purpose proving ground, ATC encompasses 56,707 acres of engineered and dedicated land and water (40 miles of test track and 250 test ranges), including restricted airspace from the surface to unlimited altitude.

ATC's comprehensive array of state-of-the-art capabilities and unique facilities, simulators, and models enable testing and experimentation from the component and subsystem level to the integrated system. ATC also uses a cutting-edge information system that incorporates innovative data-acquisition technologies. Satellite/high-band communications, coupled with database technology, enables customers to access information regarding their programs in real time through the World Wide Web. This capability enables test customers to make rapid, rational and rigorous decisions throughout a system's life cycle. Items can be subjected to a full range of tests from automotive endurance and full weapons performance with environmental extremes, to full-scale live fire vulnerability, survivability, and lethality testing as well as electromagnetic interference, fire safety, suppression, flammability, and surface/underwater shock and explosive testing. ATC is a key member of the team developing the Army's Stryker Brigade Combat Team.

b. Dugway Proving Ground (DPG). DPG serves as the T&E Reliance lead test agency and the nation's Chemical and Biological Defense Proving Ground. Effective FY97, DPG test operating funds were transferred to OSD IAW Public Law 103-160. Funds for technology, base operations, environmental, and real property maintenance remain within the Army, as well as responsibility for test management and manpower. This remote and isolated installation is composed of almost 800,000 acres in the Great Salt Lake Desert of northern Utah that is acoustically and electronically quiet, free from population encroachment, and with no interference from threatened and endangered species. As DoD's sole Major Range and Test Facility Base (MRTFB) dedicated to chemical and biological (CB) defense testing, DPG's primary mission is testing CB defense systems and performing nuclear, biological, and chemical survivability testing of defense materiel. Other unique capabilities include providing world-class meteorological and atmospheric modeling support to the MRTFB and other DoD and Federal agencies; and testing smoke and obscurant systems and illumination devices. DPG's unique facilities and capabilities include the Materiel Test Facility that provides a one-of-a-kind capability to test large equipment such as a tank or fighter aircraft using chemical agents or simulants. The Life Sciences Test Facility provides a complete capability to test biological defense equipment including a one-of-a-kind chamber to challenge defense systems with aerosolized biological agents. Dugway is also part of the Utah Test and Training Range, the largest overland safety footprint in the United States that supports aircraft weapons testing and aircraft tactical testing and training activities.

c. White Sands Missile Range (WSMR). WSMR is a unique combination of geography, laboratories, weather, personnel and support activities that make it ideal for modern land based testing. WSMR, the largest (3,200 square mile), all overland, test range in DoD, is a multi-Service use range for testing of air-to-ground and ground-to-ground munitions as well as surface-to-air, air defense, and fire support systems. In recognition of this, WSMR has been designated the T&E Reliance lead test agency for surface-to-air weapons testing. The missile

range is in the Tularosa Basin of south-central New Mexico with the headquarters located 20 miles east of Las Cruces, NM and 45 miles north of El Paso, TX. It is a fully instrumented (radar, telemetry, optical, global positioning system, timing, and meteorological) land range with restricted airspace that also supports space vehicle launches and landings as a backup site. The modern Cox Range Control Center and Launch Complex facilities provide an extraordinarily effective range control and missile/rocket launch capability. In recognition of this unique capability, ATEC recently established WSMR as the command's Inter-Range Control Center (IRCC) for its Distributed Test Capability. In this capacity, WSMR will coordinate across ATEC's multiple locations to provide an integrated live, virtual and constructive test environment in support of network-centric, system-of-systems testing. White Sands operates facilities that provide a full spectrum of battlefield environments for testing such as nuclear, electromagnetic, laser, temperature, and vibration. WSMR provides the off-range target sites for medium and intermediate range ballistic missiles launched to support extended range tests. Tenant capabilities collocated at WSMR include: the Navy's land-locked ship simulator ("Desert Ship") which supports tests of shipboard fire control and ship-based missiles and the Air Force High Speed Test Track. In addition, White Sands supports various tests for the National Aeronautics and Space Administration (NASA), other government agencies, and private industry.

d. Electronic Proving Ground (EPG). With a remote location and radio frequency interference-free environment, EPG is the principal Army test center for electronic systems, including the developmental testing of Command, Control, Communications, Computers, & Intelligence (C4I) systems, and navigation and avionics systems. Located at Fort Huachuca, AZ, EPG has access to the 76,000 acres of this southeastern Arizona fort to conduct tests, as well as selected government and private land in the area. EPG is the premier government activity for the test of distributed communication systems with emphasis on the testing of systems of systems. EPG is the developer of the Virtual Electronic Proving Ground that allows for the conducting of tests in combined real, virtual, and constructive simulation environments. Facilities here include a full range for testing of electromagnetic compatibility and vulnerability of tactical electronic equipment, the intra-/interoperability of tactical automated C4I systems (including software and documentation), TEMPEST testing, and electronic countermeasures testing. EPG has an in-house developed suite of test instrumentation that includes test control, test stimulation, test data acquisition, and virtual jamming. EPG is also the Army's flight test facility for unmanned/micro aerial vehicles and has extensive test capabilities in the areas of global positioning system testing, propagation simulation, C4I battlefield simulations, and the use of existing battle simulations in test and training activities.

e. Yuma Proving Ground (YPG). Yuma Proving Ground, at over 1,300 square miles in size, is larger than the state of Rhode Island and has facilities

that are capable of realistically, accurately, and safely testing nearly everything in the ground combat arsenal. This is the Army's large desert environment test center and long and medium range artillery testing facility. YPG is the T&E Reliance lead test agency for gun and munitions testing. In addition, many miles of test courses are used for testing prototype and operational combat vehicle systems (both wheeled and tracked). Developmental testing of Army aircraft weapon systems is accomplished, to include armament (air-to-ground) and target acquisition equipment. Production acceptance testing for Army munitions programs is conducted at YPG. YPG also tests all parachute systems for personnel and air delivery of materiel and supports extensive global positioning systems testing. In addition to its systems test mission, the extensive range facilities and support systems have been developed to allow joint Service combined arms testing/training. YPG offers the most modern mine, countermine, and demolitions test facility in the Western Hemisphere. YPG also has the management authority for extreme natural environments. Desert environment testing takes place at YPG, with cold weather testing taking place at the Cold Regions Test Center at Fort Greely, AK. The Tropic Regions Test Center, which operates in Hawaii and other tropic areas, as negotiated, conducts testing in a tropic environment, which many claim is the most damaging environmental extreme.

ATC, DPG, WSMR, EPG, and YPG are members of the DoD MRTFB.

f. Cold Regions Test Center (CRTC). The Army's cold, winter, mountain and northern environmental test center is a large, outdoors test area of over 670,000 acres with special use restricted airspace from the surface to unlimited altitude. The testing effort is centered at the Bolio Lake Test Complex, AK, from which CRTC accommodates a full range of cold weather or temperate climate tests depending on the season. Bolio Lake provides automotive cold start capabilities and a base for Soldier equipment tests. Ranges are also available for mine, explosives, small arms tests, direct fire tests, sensor testing, air defense, missile, artillery, smoke and obscurant tests and mobility testing. CRTC can accommodate indirect fire testing with the capability of observed fire to 30 km and unobserved fire to 50 km. Indirect fire, up to 100 km, can also be accomplished by utilizing ranges near Fort Wainwright, AK with the impact on Ft Greely areas. Supporting infrastructure include a facility for surveillance testing, ammunition storage area, administrative areas, communications circuits, meteorological sites and an extensive network of roads and trails. Airfield-based and tactical air operations are supported and airdrop zones/facilities are available.

g. Redstone Technical Test Center (RTTC). RTTC, located at Redstone Arsenal, AL, is the Army's foremost tester of small rockets, missiles, and associated hardware and components. It encompasses over 14,000 acres of the Arsenal and operates 650,000 square feet of test facilities. It is unique in its

provisions for testing inert and explosive components. Extensive laboratory and range test capabilities have proven to be effective means of verifying component, subsystem, and system performance before committing to flight testing. RTTC is also the only lightning effects tester of explosive items in DoD. RTTC operates the Army's largest rocket motor static test facility. The Center offers complete test capabilities for small rocket and missile systems to include flight, warhead, and motor performance. All types of natural and operationally induced dynamic, environmental, and electromagnetic testing can be performed. Sensor systems testing (radar and electro-optical) are conducted under simulated battlefield conditions including obscurants and countermeasures. RTTC performs developmental and life-cycle technical tests, as well as quality assurance and stockpile reliability testing at Redstone Arsenal, AL, and throughout the world.

h. Aviation Technical Test Center (ATTC). ATTC conducts airworthiness qualification and developmental flight testing of Army aircraft and associated systems. ATTC maintains a fleet of 16 test bed aircraft, representing the Army's fielded aviation systems (AH-64A/D, UH-60A/L, CH-47D, OH-58D, C-12). Several of these aircraft are specially equipped and instrumented to perform in-flight performance and handling qualities evaluations whereby technical engineering data can be recorded and/or telemetered to ground stations for real time or post flight analysis. Instrumentation packages can be tailored for each flight test, whereby the aircraft then becomes a flying laboratory with a flexible "Open Air Range" capability. ATTC is a tenant activity on Cairns Army Airfield, Fort Rucker, AL, with a local flying area that covers approximately 32,000 square miles. With a core competency in Open Air Range testing and a professional cadre of military experimental test pilots, government civilian flight test engineers and technicians, ATTC routinely conducts its mission throughout the continental US - wherever specific test capabilities or climatic conditions are required. ATTC is supported by several technical contracts, to include an aircraft maintenance contract with depot-level aircraft modification, fabrication and prototyping capability. ATTC also has a formal memorandum of agreement with the USAF 46th Test Wing at Eglin AFB (an MRTFB), which facilitates access by ATTC to USAF ranges and restricted airspace when necessary in support of test programs.

2. ATEC: OPERATIONAL TEST COMMAND (OTC)

OTC is the Army's independent operational test organization. OTC has the mission to conduct realistic testing in the critical areas of equipment, doctrine, force design, and training. The command conducts the operational tests required by public law that provide significant data to the Army decision makers on key Army systems and concepts. The OTC Analytic Simulation and Instrumentation Suite (OASIS) is an integrated suite of technology tools, consisting of instrumentation and simulation/stimulation systems required for operational testing, experimentation, and evaluation. Whenever possible, instrumentation

embedded in the system under test and models or instrumentation created by other organizations are used to create the environment required for an operational test and collect the necessary data. When necessary, OTC will initiate creation of instrumentation or simulation/stimulation systems required for operational testing, such as the Objective Real-Time Casualty Assessment Instrumentation System or Simulation Testing Operations Rehearsal Model (STORM). The OASIS management structure determines whether tools need to be tailored or new interfaces designed to meet the requirements of specific operational tests and ensure that necessary instrumentation interference testing and VV&A of models/simulation/stimulation systems have been completed to ensure appropriateness for operational testing. OTC is headquartered at Ft. Hood, TX and is composed of 9 test directorates and one support activity. Five of these directorates are located at Ft. Hood, TX – Future Force; Aviation; Engineer/Combat Support; Close Combat; and Command, Control, Communications and Computers. The Test & Evaluation Support Activity is also located at Ft. Hood. The remote test directorates are Intelligence and Electronic Warfare, Fort Huachuca, AZ; Fire Support, Fort Sill, OK; Airborne and Special Operations, Fort Bragg, NC; and Air Defense Artillery, Fort Bliss, TX. The backbone of OTC lies within the test directorates that go to the field to perform the tests or experiments. They perform the detailed planning, execution and reporting for all tests and field experiments within their assigned mission areas. A brief description of some of these directorates is provided in subsequent paragraphs. OTC becomes involved in the earliest phases of the Army's acquisition process to ensure that the product performs according to Army expectations. That product is handed off to OTC to test in the hands of the intended user – the Soldier. Figure 3-4 shows OTC's command structure.

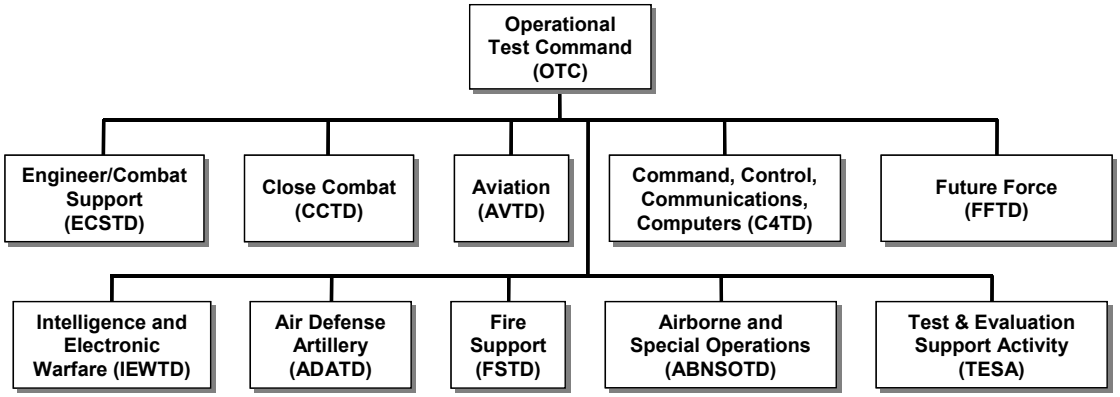


Figure 3-4. OTC Command Structure

a. Intelligence Electronic Warfare Test Directorate (IEWTD). IEWTD is located approximately 70-miles southeast of Tucson, Arizona at Ft. Huachuca. Ft. Huachuca encompasses both government and private land, making it

uniquely suitable for the conduct of operational testing. Located in a radio frequency (RF) interference free environment, IEWTD has been used for multi-Service testing of command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) system of systems. This RF environment has enabled IEWTD to range test many systems that could not be tested at other installations. IEWTD's primary mission includes planning, conducting, and reporting on operational tests and other user tests of intelligence, surveillance, reconnaissance, and electronic warfare systems.

IEWTD can provide a live, virtual, and constructive simulation environment through the use of the Intelligence Modeling and Simulation for Evaluation (IMASE) suite to focus on intelligence, surveillance, and recognizance. IMASE will accommodate scenarios up to 120 hours in duration with 150,000+ objects over a 350-km X 350-km battlespace. IMASE is designed for scenario generation, product development, product delivery, and performance scoring of the system under test.

IEWTD provides threat and vulnerability assessment instrumentation that can emulate a wide range of threat systems in support of operational, concept evaluation, and customer tests. These systems are extremely versatile and highly mobile. They provide a variety of mechanisms to measure, analyze, document, invoke, or stress a system under test in a realistic operational environment. In addition to its unique threat support instrumentation, IEWTD has the following technical support areas: Sensitive Compartmented Information Facility (SCIF), fully controlled security access, Motor Pool, and a Mobile Threat Suite, as well as scenarios. Co-located with EPG and the Joint Interoperability Test Command (JITC), IEWTD is able to provide a multifaceted approach to testing.

b. Airborne and Special Operations Test Directorate (ABNSOTD). ABNSOTD, Ft Bragg, NC has extremely specialized ground and aerial based video and still photography and force measuring (shock, strain, and oscillation) capabilities. A key component is the Video Tracking System that is a sophisticated piece of instrumentation that tracks objects from a single station rather than multiple locations. It provides near real time pointing angle with position location data of those objects within approximately two hours after mission completion. Capabilities also include recording and producing extensive digital imaging, video, and still capabilities, which can be utilized to enhance and produce test images products. Lastly, data collected can be corrected to standard day data for position location within approximately two hours after mission completion. These systems are trailer mounted, non-inclement weather capable and include Global Positioning System (GPS), laser range finding, self survey and timing, an integrated weather station, and automated video tracking. They are used extensively for air dropped troops and equipment. An airborne variant of the Geometric Automated Video Enhanced Location System (GAVELS) for multiple object position location, and an onboard GPS-based position location system are currently being tested.

c. Fire Support Test Directorate (FSTD). FSTD's Command, Control, and Communications (C3) Testbed was developed to provide the instrumentation, simulation, and stimulation (ISS) products to support the testing and evaluation of Fire Support (FS) and Field Artillery (FA) systems in a realistic operational environment. The FSTD C3 Testbed contains all of the digital command and control FS and FA tactical systems, such as the Advanced Field Artillery Tactical Data System (AFATDS), Battery Computer System (BCS), Forward Observer System (FOS), etc., and has readily available access to all the FA firing platforms and target acquisition systems. The FSTD has developed several unique ISS products to greatly reduce the cost of operational testing, whether at Fort Sill or elsewhere.

These ISS products include: the Extensible C4I Instrumentation Suite Fire Support Application (ExCIS FSA), which provides the test instrumentation suite to plan, drive, simulate and stimulate all FA and FS systems. This permits the tester to monitor, collect, archive, and reduce FA and FS technical and operational data. The ExCIS Future Combat Systems (ExCIS FCS) is in the early development stages for use in the FCS operational test environment.

GAVELS is used to locate artillery rounds exploding on targets using the Universal Transverse Mercator (UTM) coordinates and altitude. The system has one major subsystem that records events using digital video containing vital information such as GPS time, event number, and any other information that the user desires to include on each frame. A second subsystem uses the information from the camera sites and associates them with the GPS time as the common attribute. The system provides a position location accuracy of .5-meters in easting, northing, and altitude.

The Multimedia Data Transfer System (MDTS) is an ATEC asset managed by FSTD that allows the automated transfer of instrumentation data collected at multiple remote sites back to a central instrumentation control center or any other facility connected to the OTC backbone network. Data collection can be at any continental United States (CONUS) field location. The methods used to transfer data include commercial radios, wireless local area networks (LANs), satellite communications, computer networks, and fiber optic wire. Each system uses the latest computer technology, displays, and phased software integration. Four mobile satellite dishes are available for transport to any location and provide test data and test status information from a remote test site back to the home station.

d. Air Defense Artillery Test Directorate (ADATD). ADATD, located at Fort Bliss, TX, is a combat arms tester with primacy of use of 4 major test ranges, 3 base camps and 2 major maneuver areas that encompass 1600 square miles of range area with unlimited ceiling. ADATD's technology support systems have been refined to handle the dynamic operational situations for air defense and network-centric warfare. Modeling and simulation assets permit testing geographically distributed tactical hardware and software systems within the joint missile defense architecture and stimulating systems with scenarios via the Advanced/Army Tactical Data Link (ATDL)-1, Tactical Information Broadcast

System (TIBS), and Tactical Digital Information Link (TADIL) A, B, and J data links

Time-Space-Position Information (TSPI), audio/video, digital data bus, and control functions are recorded with a player and event tracking system integrated with range data using geometric pairing and Inertial GPS Integrated Pods which are mounted on test aircraft. A High-speed digital recording system records data bus and audio/video (high resolution and RGB) on one shared media. This data can transmit over the test-range local area network to the data processing/reduction facility for processing by a multi-tera-byte facility.

3. ATEC: ARMY EVALUATION CENTER (AEC)

AEC is involved early and throughout the acquisition process to ensure that T&E programs, strategies, and objectives are consistent throughout the acquisition program. Since T&E results figure prominently in the decisions reached in design and milestone reviews, early T&E involvement in the acquisition process serves to add value to the final product of any acquisition program. Working in coordination with DTC and OTC, AEC assesses system performance to determine whether it is meeting developmental and operational expectations. This effort assists in discovering any potential problem early - when fixes are easier and less costly to the materiel developer. AEC also supports key Army initiatives, such as, Advanced Warfighting Experiment (AWE), ATD, ACTD, and other fast track initiatives. In addition, AEC conducts the Army Continuous Evaluation program and live fire evaluations on all covered systems. AEC evaluates and reports on each system's effectiveness, suitability, and survivability to the Army senior leadership and, when requested, to Congress. Forming a new directorate in 2002, AEC postured itself to support the Army Transformation and the ongoing demands of the Current systems. Figure 3-5 shows AEC's organizational structure.

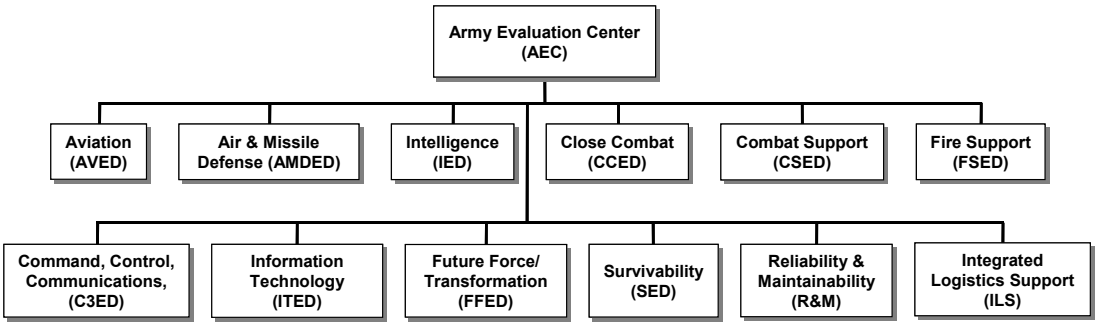
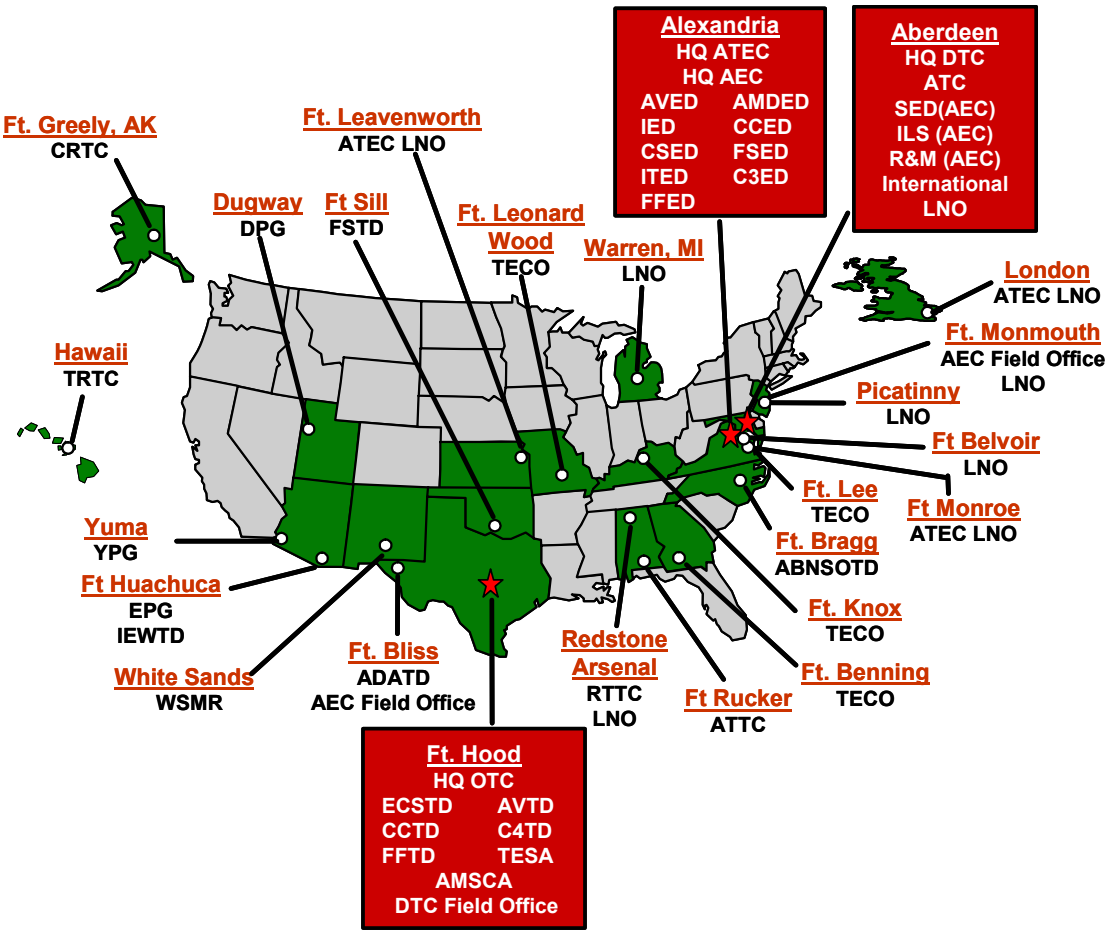


Figure 3-5. AEC Organization Structure

It is headquartered in Alexandria, VA and has twelve evaluation directorates: Aviation; Air and Missile Defense; Close Combat; Fire Support; Combat Support; Intelligence; Command, Control & Communications; Future Force /Transformation; and Information Technology, all of which are also located at Alexandria, VA. Survivability, Reliability & Maintainability, and Integrated Logistics Support are located at Aberdeen Proving Ground, MD. AEC also has a field office in Ft. Monmouth, NJ and Ft. Bliss, TX. AEC evaluates a proposed system's performance for the Army or, following a joint test, for other services. AEC customers also include the Navy, Air Force, and Marine Corps.

4. ATEC Geographic Locations

The following map (Figure 3-6) depicts the various ATEC range locations, offices and headquarters as discussed in the previous paragraphs.



Figurer 3-6 ATEC Locations

B. U.S. ARMY SPACE AND MISSILE DEFENSE COMMAND (USASMDC)

The USASMDC mission is to provide the world's best space and missile defense capabilities to warfighters and to provide for the protection of our homeland and the worldwide interests of the United States.

A 1997 Memorandum of Agreement with the Training and Doctrine Command (TRADOC) designated the command as the Army's specified proponent for space and National Missile Defense (NMD) and the Army's overarching integrator for Theater Missile Defense (TMD). To meet these added responsibilities, the command developed its *USASMDC Vision 2010.*

The vision of the Commanding General is "Normalizing space, providing layered force protection for Combatant Commanders throughout the world, developing Army Soldiers and civilians with technical skills to support the Future Force of the 21st Century."

To implement the Commanding General's vision, USASMDC is a capabilities-based organization. SMDC includes combat, materiel, and technology developers, as well as users, testers, and evaluators. USASMDC's test facilities are unique and have set many precedents in space and missile defense history. In 1958, an Army rocket launched America's first satellite into orbit. In 1962, a Nike-Zeus launched from Kwajalein Atoll intercepted an intercontinental ballistic missile. In 1984, the Homing Overlay Experiment hit a ballistic missile in flight validating hit-to-kill interceptor technology. In 1996, the High Energy Laser Systems Test Facility (HELSTF) shot down a Katyusha rocket in flight. HELSTF is the only above-the-horizon high energy laser test range which can accommodate full developmental and operational testing and evaluation. To fulfill its mission, USASMDC maintains two components of the Test Budget Operating System (TST BOS): U.S. Army Kwajalein Atoll/Reagan Test Site (USAKA/RTS) and the HELSTF. These unique facilities will enable us to lead the Army space and missile defense into the 21st Century.

1. USASMDC: U.S. ARMY KWAJALEIN ATOLL/REAGAN TEST SITE (USAKA/RTS)

The USAKA/RTS (formally the Kwajalein Missile Range) mission is to operate a DoD MRTFB element by providing a comprehensive missile testing environment and support space operations/surveillance for the warfighter. USAKA/RTS provides multi-level strategic and ballistic missile defense system testing to include system interoperability testing, sensor system research and development testing, and conducts space operations including space object identification, space surveillance, and new foreign space launch tracking in support of the U.S. Strategic Command and NASA.

As reflected in Figure 3-7, USAKA is a command element within USASMDC under the Deputy to the Commanding General for Research, Development and Acquisition in the Technical Center.

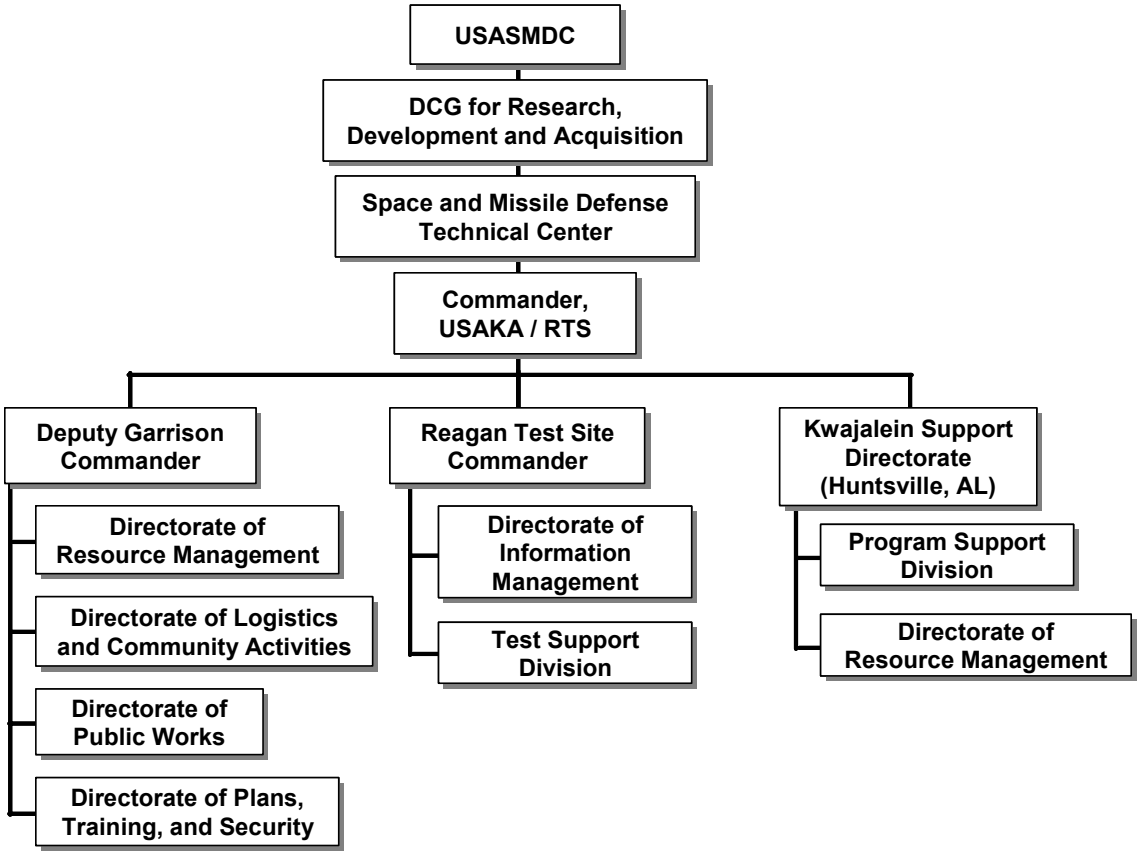


Figure 3-7. USAKA/RTS Command Structure

The USAKA/RTS is located 2136 miles southwest of Hawaii in the Republic of the Marshall Islands (see Figure 3-8, next page). Reagan Test Site is important to DoD not only for its strategic location, but also for its world-class suite of sensors that support a variety of missile testing programs and space operations. In addition to supporting hundreds of Intercontinental Ballistic Missile (ICBM) developmental and operational tests and playing an important role in space surveillance, USAKA/RTS was the site of the first ICBM intercept (Nike-Zeus, 1962), the first independent track hit-to-kill intercept of an ICBM (Homing Overlay Experiment, 1984), and numerous subsequent successful Ground Based Interceptor (GBI) intercepts including Exo-atmospheric Reentry Interceptor Subsystem (1991), Exo-atmospheric Kill Vehicle weapon systems (2000) and Ground-based Missile Defense (GMD) System tests (2000 to date). Because of its geographical location, the USAKA/RTS radars provide unique continuous first orbital revolution coverage of most Chinese, Russian, Japanese, French Guinea, Indian, and other Asian continent launches within one hour after launch. In addition, USAKA/RTS supports the Compact of Free Association with the

Republic of the Marshall Islands. USAKA/RTS's major investment projects include range safety control center improvement and modernization, Kwajalein mission control center modernization, 70/35mm film to digital conversion, MPS-36 modernization, and millimeter wave (MMW) radar performance enhancement. USAKA/RTS bandwidth requirements to meet operational and developmental testing continue to grow rapidly. To meet this increasing requirement, a submarine fiber optical cable network connecting Kwajalein to the Pacific basin optical cable network is under consideration.

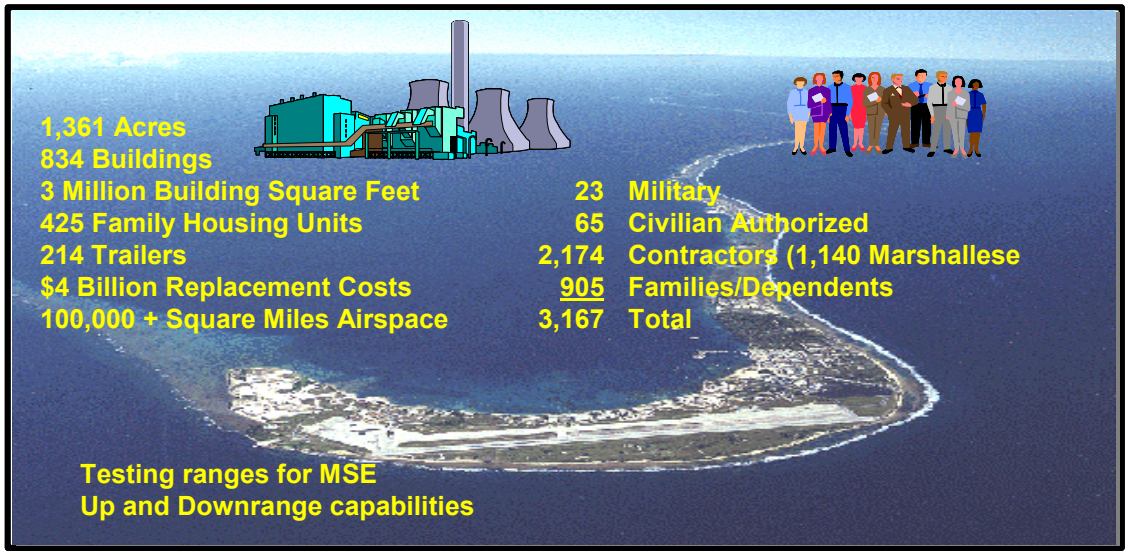


Figure 3-8. USAKA/RTS

2. USASMDC: HIGH ENERGY LASER SYSTEMS TEST FACILITY (HELSTF)

HELSTF is the Army's high-energy laser (HEL) Research, Development, Test & Evaluation (RDT&E) facility. It is located on White Sands Missile Range, New Mexico, and is managed by the USASMDC. It serves as USASMDC's primary test facility for their Directed Energy (DE) weapons programs, and is a tri-Service center for HEL RDTE. As part of the DoD's MRTFB infrastructure, HELSTF is important in the development of potential high power laser programs in part because of its strategic location at WSMR. The instrumented WSMR test range consists of 3200 square miles of controlled land area, and 7000 square miles of controlled air space. This geographic location of HELSTF on WSMR-proper allows it to accommodate live missile and rocket, artillery, and mortar (RAM) projectile shoot-down tests. HELSTF is an accredited predictive avoidance site with the US Strategic Command Laser Clearinghouse and is an approved above-the-horizon HEL test facility.

The HELSTF array of lasers (low power to megawatt-class), beam directors, sensors, associated equipment, meteorological measurement capabilities,

multiple test areas, and pointing and tracking systems provides a unique opportunity for researchers and testers to conduct laser experiments and tests. Additionally, complete data reduction is provided for all tests and data analysis is available to all users. Figure 3-9 illustrates HELSTF capabilities.

- **Mid Infra-Red Advanced Chemical Laser - High Power Deuterium Fluoride (DF) Damage and Vulnerability Tests**

- **Large Vacuum Chamber - Simulates Space Environment, Inject High Power Beam**
- **SeaLite Beam Director - High/low Power Dynamic Tests**
  - **Support to MDA TMD Programs**
- **Test Areas**
  - **Outdoor Sub-system to Full-scale Static Testing**
  - **Indoor Coupon Materials Testing**
- **MTHEL Demonstrator Support - Developmental and Operational Tests**
- **Solid State Heat Capacity Laser - 10kW Flashlamp Pumped Testbed**

Figure 3-9. HELSTF Capabilities and Facilities

HELSTF is helping to support Army Future Force development by expanding its model and simulation capabilities to support HEL lethality analysis. HELSTF is working jointly with other SMDC major subordinate command elements to support the development of military utility analyses for a variety of proposed Army HEL weapon systems and develop a wide-band communication capability so that we can participate in exercises from our location. HELSTF is planning a modernization effort to support Developmental Test and Evaluation (DTE) and OTE for emerging laser weapons in the Future Force and other Service forces. This modernization plan includes a mobile HEL diagnostic suite, (supports mobile range operations), complete modernization of our existing control system, upgrades to our fixed HEL diagnostic instrumentation, and addition of an array of beam directors to support development and system of systems testing of battle management command and control for future HEL weapons. The Chapter V test technology roadmaps provide details for these modernization efforts.

HELSTF can currently perform a variety of tests with several high and intermediate power lasers. There are test areas for full scale target explosive and hazardous testing, material effects testing, and testing while under vacuum (simulated space environment). For dynamic live-fire lethality testing against missiles, RAM projectiles, remotely controlled ground targets, and airborne

targets, HELSTF uses the Sea Lite Beam Director (SLBD) to project the laser onto the target.

3. USASMDC: Big Crow Program Office

The Big Crow is an electronic warfare (EW) asset developed in 1970. Big Crow program management was transferred from ATEC to USASMDC on 3 January 2000. Big Crow is a national asset capable of testing new equipment for susceptibility to electronic countermeasures, for training forces to operate in an EW environment, and for permitting operating forces to perform special missions. The Big Crow EW equipment and instrumentation suites enable the user to emulate every known EW threat environment. All equipment suites are off the shelf equipment and rapidly reconfigurable from one platform to another depending on the scenario. Current platforms range from aircraft to ground vehicles. The Army is responsible for managing the program including two specially configured KC-135 platforms, provided by the Air Force, as the primary operating platforms.

C. PROJECT MANAGER FOR INSTRUMENTATION, TARGETS, AND THREAT SIMULATORS (PM ITTS)

PM ITTS, under the Program Executive Office, Simulation, Training, and Instrumentation (PEO STRI), provides acquisition discipline to the research, development, production, and fielding of major instrumentation, targets, and threat systems required for developmental and operational T&E for the Army. In support of its mission, PM ITTS manages three executing activities responsible for the development, fielding, and in some cases, the maintenance and operation of the items they produce. Figure 3-10 shows the PM ITTS organization and reporting chain.

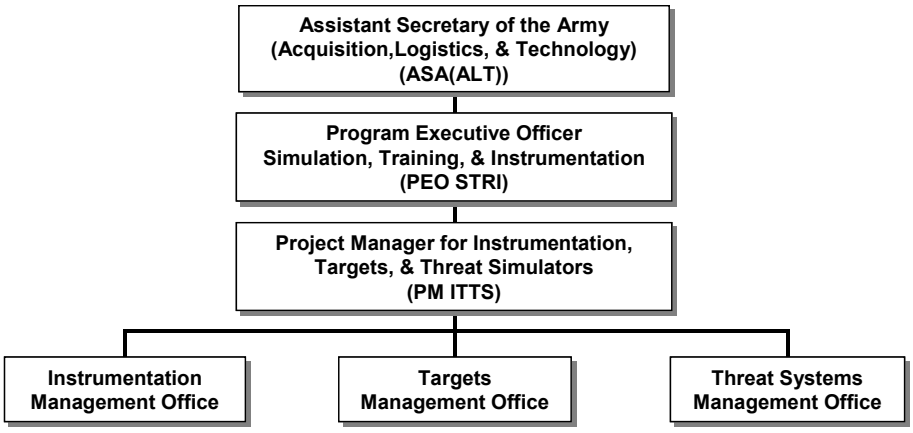


Figure 3-10. PM ITTS Command Structure

One of these activities, the Instrumentation Management Office (IMO), is located with the PM office in Orlando, FL, while the Targets Management Office (TMO) and the Threat Systems Management Office (TSMO) are located at Redstone Arsenal, AL. TSMO Operations, formerly the ATEC Threat Support Activity (ATSA), is located at Ft. Bliss, TX. This activity provides the realistic and simulated threat system support to operational testing and Army training (see figure 3-11).

Figure 3-11. PM ITTS Activities

PM ITTS customers are ATEC, TRADOC, Army field commands, reserve components, Army laboratories, other DoD Services and agencies, international cooperative activities, foreign military sales, and project managers/program executive offices requiring instrumentation, targets, and threat systems. Additionally, some test systems are developed to address tri-Service needs under the Central Test and Evaluation Investment Program (CTEIP). PM ITTS executes projects under CTEIP for which the Army has lead responsibility. For the live, virtual, and constructive simulation domains, PM ITTS executes developmental and operational test investments, including instrumentation, aerial/ground targets and target control systems, and threat simulators and simulations. PM ITTS provides scalable threat simulations for the virtual testing and training environments, manages a variety of foreign materiel in support of testing and training, and manages procurement lines in support of the production of test and training investment assets. In addition, PM ITTS sponsors the Army Model Exchange (AMX) in coordination with the AMC Research, Development and Engineering Command (RDECOM) to provide a repository for government

owned models, promoting reuse for all DoD agencies involved in modeling and simulation.

Test, Training and Technology Integration (T3I) Office. PM ITTS maintains a T3I Office, jointly funded with other organizations, in the Washington, DC area headed by the Assistant Project Manager for T3I. The role of this office is to:

- Identify, advocate, coordinate, and integrate technologies which have mutual benefit to Army testers and trainers and other government agencies.
- Represent Army test and training materiel developers, including leadership of the Army inputs to the Joint Test and Training Range Roadmap (JTTRR), Transformation and Future Force developments, and other joint activities.
- Serve as PM ITTS liaison to the National Capitol Region, the Department of Homeland Security, and civil law enforcement agencies.

Other test-related programs executed by the T3I Office include:

- **Advanced Technology Investigation Process (ATIP)**, which examines Army modernization's impacts upon T&E and training.
- **Army Test and Training Requirements Online (ATTRO)**, which provides a web-accessible tool set to rapidly capitalize upon the ATIP findings and support test and training budgetary requests.
- **Army Test and Training Investments Conference (ATTIC)**, which provides the Army with an annual gathering to discuss technological requirements and solutions among its communities.

D. SURVIVABILITY, LETHALITY, AND ANALYSIS DIRECTORATE (SLAD)

The Survivability/Lethality Analysis Directorate is the Army's primary source of survivability, lethality, and vulnerability (SLV) analysis and evaluation support, adding value over the entire system life cycle. SLAD is a subordinate activity of the Army Research Laboratory (ARL) (ARL reports to the Research, Development and Engineering Command (RDECOM), a subordinate command of AMC). Figure 3-12, on the following page, depicts the SLAD hierarchical command structure. SLAD's principal mission is to ensure that Soldiers and the systems they operate can survive and function on the battlefield. SLAD is committed to assisting the Army in achieving its modernization goals by helping acquire systems to help Soldiers survive in all environments against the full spectrum of battlefield threats. These threats include conventional ballistics, EW, information warfare (IW), electromagnetic environment effects (E3), and nuclear, biological, chemical (NBC).

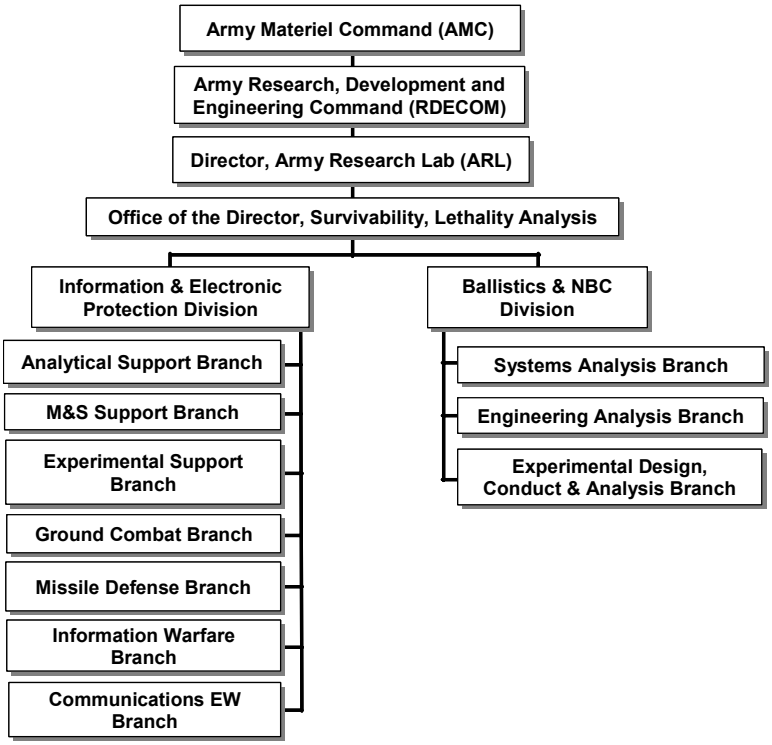


Figure 3-12. SLAD Command Structure

SLAD performs a variety of functions: conducts investigations, experiments, simulations and analyses to quantify SLV of Army and selected foreign weapon systems; provides well-documented, timely, technical judgments on complex SLV Issues; provides advice and consultation on SLV issues to ATEC, HQDA, PEOs, PMs, evaluators, combat developers, battle labs, intelligence activities, and selected other DA and DoD activities; performs special studies and makes recommendations regarding tactics, techniques or design modifications to reduce vulnerability and enhance survivability and lethality of Army materiel; and, develops tools, techniques and methodologies for improving SLV analysis. SLAD is headquartered at Aberdeen Proving Ground, MD, with sites at White Sands Missile Range, NM, and Ft. Monmouth, NJ (see Figure 3-13).

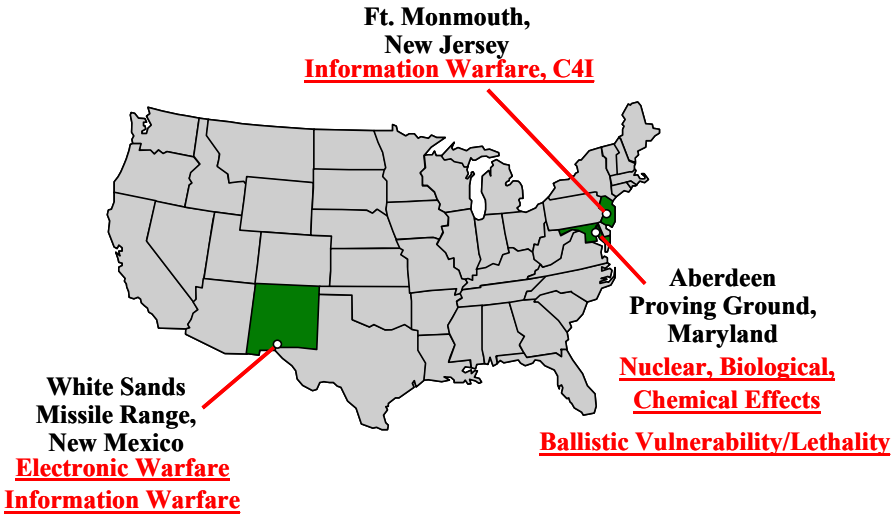


Figure 3-13. SLAD Activities

SLAD's value to the Army is based upon its SLV scientific and engineering skills and its analytical tools used to conduct SLV investigations, simulations, and lab/field experiments. A Memorandum of Agreement establishes the relationship between ATEC and ARL/SLAD with respect to evaluation of Army systems. SLAD provides support in the area of survivability/lethality analysis based on requirements provided by ATEC.

E. ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY (AMSAA)

AMSAA headquarters is located at Aberdeen Proving Ground, MD and reports through RDECOM to the Army Materiel Command. AMSAA's core mission is to conduct responsive and effective materiel, logistics, and industrial systems analyses to support decision making for equipping and sustaining the US Army and its Soldiers. AMSAA has organized and focused its capabilities into five core business areas: item/system performance and investment strategies; M&S; acquisition and technology support; logistics analysis; and

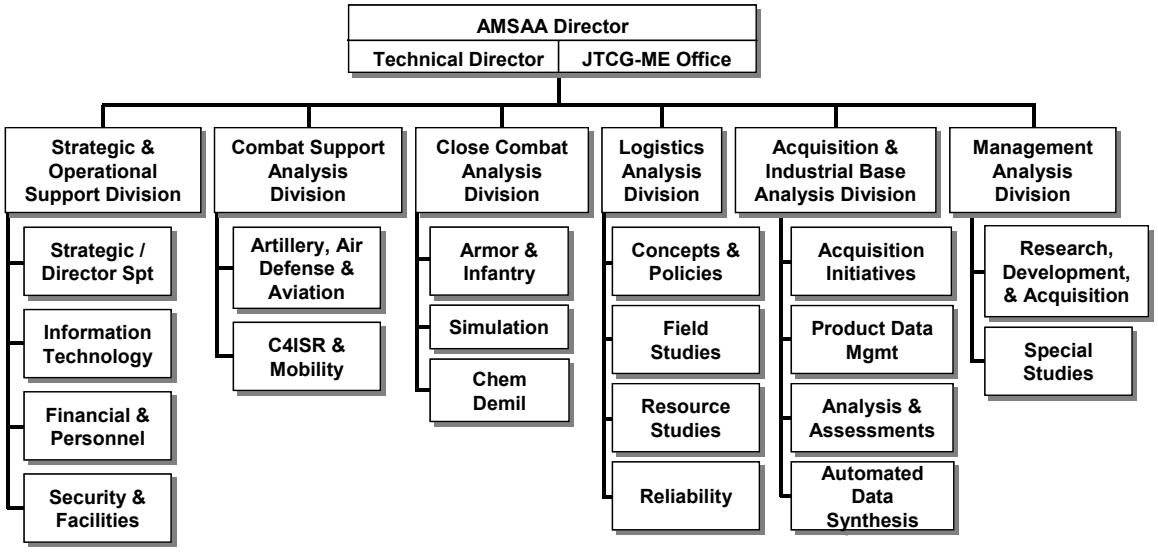


Figure 3-14. AMSAA's Organizational Structure

business and resource analysis. These interdependent core competencies allow AMSAA to provide the Army with unique analytical capabilities spanning the spectrum of Army Transformation. Figure 3-14 depicts AMSAA's organizational structure.

AMSAA is the Army's center for item/system level performance analysis and certified data. In accomplishing its materiel systems analysis mission, AMSAA analyzes the performance and combat effectiveness of conceptual, developmental, and existing systems. Unique models and methodologies have

been developed to predict critical performance variables, such as, weapon accuracy, target acquisition, rate of fire, probability of inflicting catastrophic damage, and system reliability. AMSAA is responsible for the generation of these performance and effectiveness measures and for ensuring their standard use across major Army and Joint studies. AMSAA conducts and supports various systems analyses, such as: analyses of alternatives (AoAs), system cost/performance tradeoffs, early technology tradeoffs, weapons mix analyses, and requirements analyses. These analyses are used by the Army and DoD leadership in making acquisition, procurement, and logistics decisions in order to provide quality equipment and procedures to the Soldiers.

AMSAA's M&S capabilities support the development, linkage, and accreditation of live, virtual, and constructive simulations, and provide unique tools that support systems analysis of individual systems and the combined-arms environment. AMSAA maintains a significant number of models and simulations, most of which were developed in-house to address specific analytical voids. This M&S infrastructure provides a hierarchical modeling process that is unique to AMSAA and allows for a comprehensive performance and effectiveness prediction capability that can be utilized to make trade-off and investment decisions prior to extensive and expensive hardware testing. AMSAA is the Army's executive agent for the VV&A of item/system level performance models. In this role, AMSAA assists model developers with the development and execution of verification and validation plans to ensure new models and simulations faithfully represent actual systems.

AMSAA serves as the Army's Executive Agent for reliability and maintainability standardization improvement by developing and implementing reliability and maintainability acquisition reform initiatives. AMSAA develops and applies reliability-engineering approaches that assess the reliability of Army materiel and recommends ways to reduce life cycle costs. The Physics of Failure (PoF) program pioneered the development of design and analysis tools to predict reliability and minimize potential redesign at the component level by utilizing computer-aided engineering tools in the analysis of root-cause failure mechanisms during the system design process.

As the Army's center for materiel systems analysis, AMSAA provides the technical capability to support Army and DoD decision-makers throughout the entire materiel acquisition process in responding to analytic requirements across the full spectrum of materiel. It is critical that the Army have access to AMSAA's integrated analytical capability that provides timely, reliable, and high quality analysis on which Army leadership can base the complex decisions required to shape the future Army. AMSAA has developed an integrated set of skills and tools focused on its core competencies to be responsive to the breadth and depth of systems analysis requirements critical in supporting Army Transformation decisions.

The capabilities of AMSAA in the RDT&E area are critical to the success of the Transformation Campaign Plan, specifically:

Line of Operation 2:	Modernization and Re-capitalization
Line of Operation 8:	Operational Force Design
Line of Operation 9:	Deploying and Sustaining
Line of Operation 10:	Develop and Acquire Advanced Technology

Figure 3-15 depicts AMSAA's geographical locations.

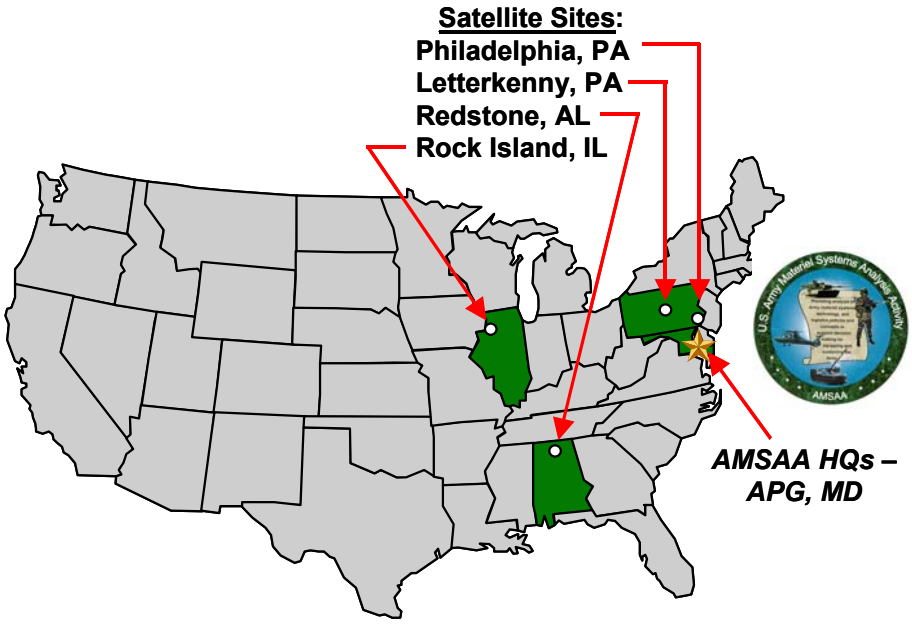


Figure 3-15. AMSAA Locations

Chapter IV. Resource Management Structure

The Planning, Programming, Budgeting, and Execution System (PPBES) is the Army's primary resource management system. The PPBES develops and maintains the Army portion of the defense program and budget. It supports Army planning, program development, and budget preparation at all levels of command. It supports execution of the approved program and budget, and provides feedback during the planning, programming, and budgeting phases. AR 1-1 describes the PPBES and its process.

A structure consisting of resource packages known as Management Decision Packages (MDEPs) is used to map Army resources to areas of management concern. Each MDEP describes a particular organization, program, or function and records the resources needed to get an intended output. Collectively, MDEPs account for all Army resources, and give the Army a key resource management tool.

One of the principal uses of MDEPs is to provide a structural basis for competing for resources with other program undertakings. This is accomplished by partitioning the MDEPs into six groupings called Program Evaluation Groups (PEG). The six PEGs are: ***Manning (MM), Training (TT), Organizing (OO), Equipping (EE), Sustaining (SS), and Installations (II).***

A. The Equipping PEG

Of the six PEGs, the Equipping PEG covers the funding of the T&E community by addressing the integration of new doctrine, training, organization, and equipment to develop and field warfighting capabilities for the Active Army, Army National Guard (ARNG), and United States Army Reserve (USAR). The PEG focuses mainly on research, development, and materiel acquisition. It also considers operating and support costs to field weapons and equipment as well as the costs of incremental sustainment and combat development.

The Test Budget Operating System. Within the EE PEG, MDEPs are grouped by Budget Operating Systems (BOS). A BOS consists of a set of MDEPs that represent a common function on the battlefield or a common activity of the supporting Army infrastructure. The MDEPs in the EE PEG are grouped into 16 BOS's. The Test (TST) BOS consists of the three MDEPs shown in Table 4-1:

MDEP	Description	Appropriation
RL02	Army Test Range Infrastructure	RDTE/OMA/MCA
RL04	Analysis and Evaluation	RDTE
RL07	T&E Instrumentation	RDTE/OMA

Table 4-1. TST BOS MDEPs

B. The TST BOS Program Elements

Each of the three MDEPs in the TST BOS is composed of a series of Program Elements (PE). Each PE corresponds to a specific operation or function relative to the MDEP contained therein. Across the three TST BOS MDEPs, there are a total of fifteen PEs. Table 4-2 provides the alignment of the fifteen PEs with the T&E organization.

Organization	PE & Project	Title	MDEP
ATEC (DTC)	665601/F30	Army Test Ranges and Facilities	RL02
	665602/628	Test Technology & Sustaining Inst	RL07
	665801/M53	Developmental Test Cmd/Center Spt	RL02
	665702/128	Met Support to DTC Activities	RL02
ATEC (OTC)	665712/V02	ATEC Activities	RL02
	665712/001	ATEC IOTE	RL02
	665602/62B	Operational Testing Instrumentation Development	RL07
	665602/62C	Modeling & Simulation Instrument.	RL07
	122015	Combat Dev Test Exper & Instr	RL07
ATEC (AEC)	665716/302	Army Evaluation Center	RL04
SMDC	665301/614	U.S. Army Kwajalein Atoll	RL02
	665605/E97	DoD HELSTF	RL02
	664759/983	Major T&E Investment USAKA	RL07
PM ITTS	664759/984	Major Technical Test Instrumentation	RL07
	664759/986	Major User Test Instrumentation	RL07
	664256/976	Army Threat Simulator Program	RL07
	664258/238	Aerial Targets	RL07
	664258/459	Ground Targets	RL07
	MA6700	Special Equipment for User Testing	RL07
SLAD	655604/675	Army Survivability Analysis & Evaluation Support	RL04
AMSAA	665706/541	Materiel Systems Analysis	RL04

Table 4-2. TST BOS Program Elements by Organization

Figure 4-1 on the following page depicts the MDEP flowchart pertaining to the fifteen PEs and their respective MDEPs.

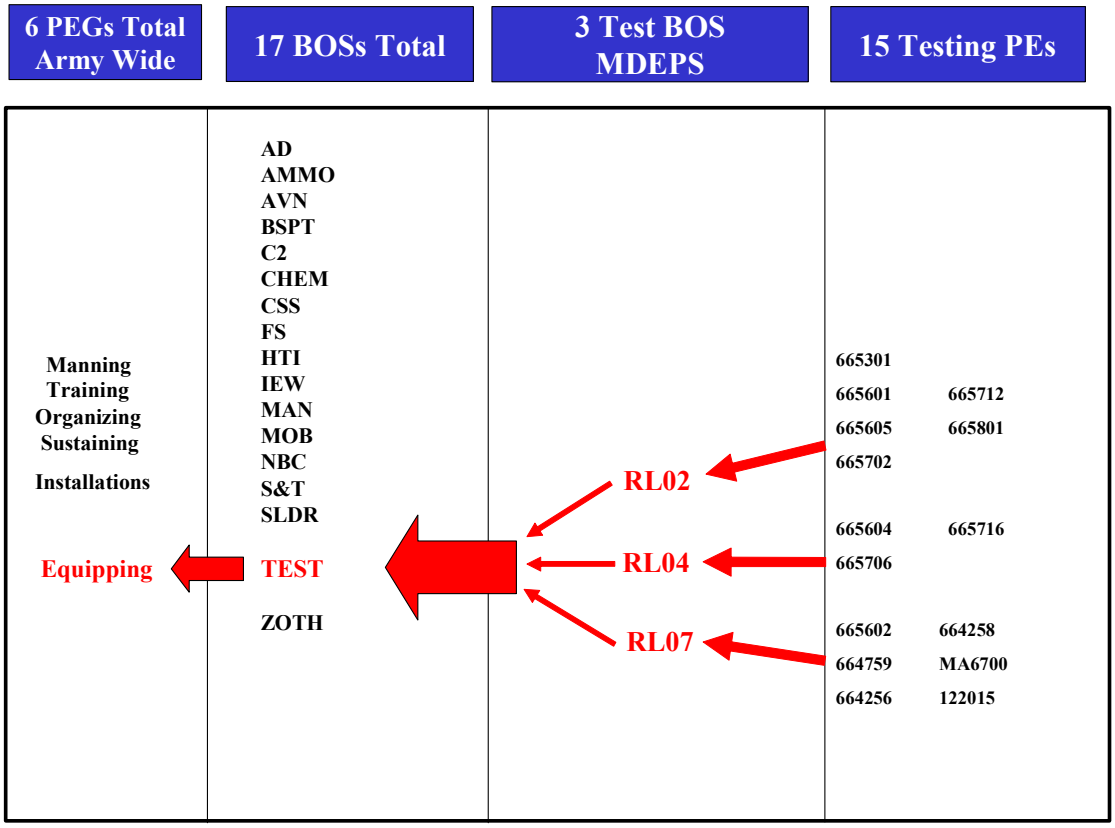


Figure 4-1. MDEP Flowchart

The following discussion represents extracts from the September 2004 Congressional Descriptive Summary, RDT&E R-2 and R-2A Exhibits.

1. 665601 Army Test Ranges and Facilities

Project F30 - Army Test Ranges & Facilities: Finances the operation of the DT ranges and test centers. This includes indirect test operating costs not appropriately billed to test customers, replacement of test equipment and revitalization/upgrade projects to maintain current testing capabilities and improvements to safety, environmental protection, efficiency of test operations, and technological advances. This program does not finance reimbursable costs directly identified to a user of the DT ranges. These direct costs are borne by materiel developers and project/product managers in accordance with DoD Directive 3200.11 and DoD Financial Management Regulation 7000.14R. In also provides for integrated test planning plus safety assessment/verification.

Developmental test capabilities at each test range have been uniquely established, are in place to support independent T&E requirements of funded weapon programs, and are required to assure technical performance, adherence to safety requirements, reliability, logistics supportability, and quality of materiel in development and production. Current testing capabilities are not duplicated

within DoD and represent what is needed to assure acceptable risk to the Soldier as new technologies emerge into fielded weapons systems

2. 665602 Army Technical Test Instrumentation & Targets

Project 628 - Test Technology & Sustaining Instrumentation: This project finances critical front-end investments for the development of new test methodologies, test standards, advanced test technology concepts for long-range requirements, future test capabilities, and advanced instrumentation prototypes for DTC. These capabilities support the development and fielding cycle of the Army Transformation from the Current Force to the Future Force as well as Joint Vision 2020 initiatives. Sustaining instrumentation maintains existing testing capabilities at DTC test facilities by replacing unreliable, uneconomical, and irreparable instrumentation, as well as incremental upgrades of instrumentation and software, to assure adequate test data collection capabilities. This PE develops and sustains developmental test instrumentation and capabilities that provide the data necessary to support acquisition milestone decisions for all commodity areas throughout the Army and in direct support of all Army Transformation elements.

Project 62B – Operational Testing Instrumentation Development: This project finances technical upgrades and maintenance of essential operational test instrumentation. Funding supports development and sustainment of cost effective technologies such as: data collection, data processing, telemetry, miniaturization, synthetic jammers, embedded instrumentation, mobile instrumentation, information assurance, and electronic warfare. As digitization of the battlefield continues, this effort allows OTC to modernize and develop its non-major instrumentation so that it can be integrated with automated instrumentation and a combat simulation capability for operational tests.

Project 62C – Modeling and Simulation Instrumentation: This project provides a critical foundation necessary to develop and sustain ATEC's current and future modeling and simulation instrumentation efforts critical to test and evaluate the increasingly complex systems of the Army Future Force.

3. 665702 Meteorological Support to Research, Development, Testing & Evaluation Activities

Project 128 - Meteorological Support to Developmental Test Command (DTC) Activities: This project provides standard and specialized weather forecasts and data for test reports to satisfy Army/DoD RDT&E test requirements for modern weaponry, i.e., (1) Unique atmospheric analysis and sampling to include atmospheric transmittance, extinction, optical scintillation, infrared temperature, aerosol/smoke cloud dispersion characteristics, ballistic meteorological measurements, snow characterization and crystal structure; (2)

Test event forecasting to include prediction of sound propagation for ballistic firing tests, specialized prediction of light levels and target-to-background measurements and predictions for electro-optical testing and ballistic artillery/mortar firing; (3) advisory and warning products such as go-no-go test recommendations for ballistic and atmospheric probe missiles, smoke obscurant tests, hazard predictions for chemical agent munitions disposal, monitoring dispersion of simulant clouds for chemical/biological detector tests, simulated nuclear blasts, and weather warnings for test range safety. Provides technical support to Army PEOs, PMs, and the DTC test ranges and sites. Develops methodologies and acquires instrumentation and systems that allow meteorological teams to support current and future Army/DoD RDTE requirements. This PE finances indirect meteorological support operating costs not billable to customers and replacement/upgrade of meteorological instrumentation. Direct costs for meteorological support services are not funded by this PE, but are borne by the customer (i.e. materiel/weapons developers and project/product managers) in accordance with DoD Directive 7000.14R.

4. 665712 Support of Operational Testing

Project V02 – ATEC Activities: This project finances base recurring costs for OTC directorates that are essential for conducting realistic and continuous testing in the critical areas of equipment, doctrine, force design and training. The primary mission of these test directorates is to conduct operational testing of developmental materiel, initial operational test and evaluation, follow-on test and evaluation, force development test and experimentation (FDTE), and Army Warfighting Experiments (AWE). This project also finances requirements for various Test and Evaluation Liaison Offices.

Project 001 - ATEC IOTE: This project funds the Army's direct costs of planning and conducting Multi-Service OT&E (MOTE) of programs without an Army PM and Army requirements of Joint T&E (JT&E) to evaluate concepts and address needs and issues that occur in joint military environments. JT&E is chartered to conduct T&E and provide information required by Congress, OSD, the Unified Commands, and DoD components relative to joint operations. Also funds Follow on Test and Evaluation (FOT&E) done after the full production decision to assess system training and logistics, to verify correction of deficiencies identified during earlier testing and evaluation, and to ensure that initial production items meet operational effectiveness, suitability and supportability thresholds.

5. 665801 Program-wide Activities

Project M53 – Developmental Test Command/Center Support: This project finances civilian labor and support costs for the technical direction and administrative functions of HQ, DTC and is required to support accomplishment of assigned developmental test and evaluation missions not directly related to

specific test and evaluation projects. This project includes staff/management functions of resource management, safety, security, environmental, strategic planning and Automated Data Processing Equipment (ADPE)/information technology support for command-wide databases in support of the developmental test mission with oversight and management responsibility of five MRTFBs.

6. 122015 Combat Developer Test Experimentation and Instrumentation

ATEC Operations and Maintenance, Army (OMA) funds are necessary to support continuing maintenance and minor upgrades of essential instrumentation once it has been developed. The complex instrumentation systems necessary to collect operational test data from modern weapons systems are now equally complex and software intensive, each requiring a cadre of highly skilled and experienced specialists for continual maintenance, re-configuration, and upgrades to mitigate obsolescence. Funds support hardware and software sustainment as well as procurement of critical spare parts for field instrumentation systems.

7. 665716 Army Evaluation Center

Project 302 - Army Evaluation Center: Funds the Army Evaluation Center mission of evaluation and test design. AEC is the Army's independent evaluator for both technical and operational tests of developmental systems for all Army acquisition programs. AEC provides integrated technical and operational evaluations, and life-cycle Continuous Evaluation of assigned Major Defense Acquisition Programs (MDAP), Major Automated Information Systems, and In-Process Review (IPR) programs for major milestone decisions, materiel changes, and materiel releases in support of the Army Acquisition Executive and force development. AEC develops the evaluation strategy, designs technical and operational tests, and evaluates the test results to address the effectiveness, suitability, and survivability factors pertinent to the decision process, such as: Critical Operational Issues & Criteria (COIC), system performance, Soldier survivability, performance in countermeasures, system survivability, reliability, supportability, etc. AEC has the lead in the planning and execution of Army live fire tests and continuous evaluations through its evaluation and test design responsibilities. This project funds the salaries of civilian employees assigned to the evaluation and test design missions and associated costs including temporary duty, support contracts, supplies, and equipment. Additionally, this project funds the "early involvement" initiative whereby ATEC liaison personnel are co-located with PEOs. The intent is to achieve cost savings and design efficiencies early in a system's development, thereby avoiding more expensive product improvement programs later in a system's life cycle.

8. 665301 Army Kwajalein Atoll

Project D614 – U.S. Army Kwajalein Atoll: Funds the government-managed/contractor-operated USAKA/RTS to support to the Army, Missile Defense Agency (MDA), Air Force test and evaluation of major Army and DoD missile systems, and to provide Space surveillance and space object identification in support of the U.S. Space Command and NASA scientific and space programs. This program also provides funds for the contractors to accomplish installation operations and maintenance (O&M). Funding is required to maintain minimal O&M support to include facilities maintenance and repair, transportation, medical, food services, education and information management to the self contained islands of USAKA.

9. 665605 DOD High Energy Laser Systems Test Facility (HELSTF)

Project E97 - DoD High Energy Laser Systems Test Facility (HELSTF): Provides funding for HELSTF to support testing of laser effects for targets ranging from material coupon testing up through full-scale static and dynamic targets, explosive targets, and testing of targets in a simulated space environment. Funds development of state-of-the-art HEL diagnostic capabilities, complete modernization of the HELSTF control systems, a robust Battle Management Command and Control Testbed and a mobile HEL diagnostic test suite to support development, operational and system of systems testing for potential HEL weapons in the Army Future Force in all relevant combat environments.

10. 664759A Major Test and Evaluation Investment

Project D983 - Major Test and Evaluation (T&E) Investment - USAKA: Funds the purchase of major Improvement and Modernization (I&M) equipment for USAKA/RTS. Provides for the upgrade of radars, telemetry, optics, communications, command/control and other equipment required to maintain RTS as a national test range. These upgrades are critical to maintain a state of the art sensor suite and to the success of TMD and GMD test missions and STRATCOM's Space Surveillance Network and Space Object identification operations.

Project D984 - Major Technical Test Instrumentation: Develops and acquires major test instrumentation to perform developmental testing of weapon systems at DTC ranges and test centers. Projects are designated major based on their visibility, assessed relative technical risk (medium-high), schedule risk, cost (generally greater than $1M/yr or $5M total project) and applicability to other mission areas or services. These projects are technically demanding, state of the art, unique instrumentation assets or suites to meet the technology shortfalls,

and generally result from development programs managed by a professional project management team.

Project D986 - Major User Test Instrumentation: Finances the development of major field instrumentation for OT, FDTE, and AWE for OTC to support Army Transformation. Each initiative is directly tied to tactical systems that support each of the five Army Modernization Plan operational capabilities. These initiatives will provide the necessary tools to collect, store and analyze data from the digital battlefield.

11. 664256 Threat Simulator Development

Project D976 – Army Threat Simulator Program: Finances the design, development, integration and fielding of realistic mobile threat simulators and realistic threat simulation products utilized in Army training, developmental tests and operational tests. Army Threat Simulator and Threat Simulation products are utilized to populate test battlefields for ATEC-conducted developmental and operational tests, and to support PEO-required user testing in System Integration Laboratories and hardware/simulation in the loop facilities. Army threat simulator and threat simulation products developed or fielded under this program support Army-wide requirements defined in the AMC chartered Threat Simulator and Simulation Program Plan (TSPP) that are identified as non-system specific threat product requirements. Each capability is pursued in concert and coordination with existing Army and tri-Service capabilities to eliminate duplication of products and services while providing the proper mix of resources needed to support Army testing and training. Threat simulator development is accomplished under the auspices of PM ITTS, and Director, Operational Test and Evaluation, Threat Simulator Investment Working Group. These affiliations minimize any development duplication within the U.S. Army or DoD.

12. 664258 Target Systems Development

Project D238 – Aerial Targets: Provides for development, acquisition, operation, storage, update, and maintenance of realistic surrogate or acquired threat high-performance, multi-spectral aerial targets and development of virtual target computer models of aerial targets. Modern weapons require test, evaluation, and training using threat representative aerial targets to assess their effectiveness on the battlefield. This program encompasses a family of rotary and fixed-wing targets; full-scale, miniature and subscale targets; virtual targets; ancillary devices; and their control systems. In order to stress systems under test and evaluation, aerial targets must have flight characteristics, signatures, and other performance factors that emulate the modern threat.

Project D459 – Ground Targets: Funds Army efforts to support T&E of advanced weapon systems and supports Army Transformation by developing surrogates, acquiring foreign equipment, and developing virtual target computer

models of ground vehicle targets. These products are required to adequately stress weapon systems undergoing T&E. This tasking includes: long-range planning to determine future target needs and development of coordinated requirement documents; the centralized management of the ground target research, development, test and evaluation processes; execution of the validation process; acquisition of foreign equipment; and continuing maintenance, storage, and development/enhancement/update via engineering services of developed and acquired targets to ensure availability for test and evaluation customers. This project also manages the use of current assets and operates a centralized spare parts program. The U.S. Army is the Tri-Service lead for providing mobile ground targets for test and evaluation.

13. MA6700 Special Equipment for User Testing

Special Equipment for User Testing: This program provides funding for PM ITTS to procure instrumentation and threat simulators to support operational testing requirements.

14. 665604 Lethality/Survivability Analysis

Project D675 – Army Survivability Analysis & Evaluation Support: This project finances the investigation of the survivability, lethality and vulnerability of designated Army systems to all battlefield threats. It supports transforming the Army to a highly effective mobile force depending on symmetry between survivability, lethality, mobility, MANPRINT, deployability, and sustainability. This project provides lethality and survivability data of potential systems in the Stryker and Future Forces to achieve a symmetric mix of force effectiveness. The analysis is integrated across all battlefield threats (i.e. conventional ballistic, electronic warfare, and directed energy). The results are used in the following ways: by each PM and PEO to direct weapon system development efforts and structure product improvement programs; by ATEC when they provide system evaluation in support of milestone decisions; by the user to develop survivability/lethality requirements, doctrine and tactics; and by decision makers in formulating program/product decisions. Additionally this project supports survivability analysis, information warfare, and information operations of Army communications, electronic equipment, and digitized forces against friendly and enemy threats. It provides field threat environment support for Electronic Warfare Vulnerability Analysis (EWVA), analyzes vulnerabilities of foreign threat weapons and C4ISR and Intelligence Electronic Warfare (IEW) systems to U.S. Army EW systems. Provides threat weapon electronic design data to countermeasure developers and technical capability information to the intelligence community. Supports Army initiatives in vulnerability reduction of C4I/IEW systems against battlefield threats, including information warfare. Provides analysis for understanding potential vulnerabilities of Digitized Force developmental systems. Supports Army Warfighting Experiments and associated Information Operations Vulnerability Assessments for Digitized Force

Architecture. Supports vulnerability analysis of situational awareness data of the Transformation Force. Analysis includes survivability and vulnerability analysis of ground systems of the Stryker and Future Force for Army Transformation and other Army ground combat systems; Army air defense and missile defense systems; Army aviation systems and UAVs; Army fire support weapons (smart and conventional); Horizontal Technology Integration systems, ATD initiatives, and proposed survivability enhancements to weapon platforms.

15. 665706 Materiel Systems Analysis

Project M541 – Materiel Systems Analysis: This project finances Department of the Army civilians at the AMSAA to conduct its mission of materiel systems analysis. AMSAA is the Army's center for item/system level performance analysis and certified data. In accomplishing its materiel systems analysis mission, AMSAA analyzes the performance and combat effectiveness of conceptual, developmental, and existing systems. Unique models and methodologies have been developed to predict critical performance variables, such as weapon accuracy, target acquisition, rate of fire, probability of inflicting catastrophic damage, and system reliability. AMSAA conducts and supports various systems analyses, such as: analyses of alternatives (AoAs), system cost/performance tradeoffs, early technology tradeoffs, weapons mix analyses, and requirements analyses. Army and DoD leadership use these analyses' results to make acquisition, procurement, and logistics decisions in order to provide quality equipment and procedures to our Soldiers. In addition, this project finances AMSAA's M&S capabilities, which support the development, linkage, and accreditation of live, virtual, and constructive simulations, and provide unique tools that support systems analysis of individual systems and the combined-arms environment. AMSAA has resident and maintains a significant number of models and simulations, most of which were developed in-house to address specific analytical voids. This M&S infrastructure provides a hierarchical modeling process that is unique to AMSAA and allows for a comprehensive performance and effectiveness prediction capability that can e utilized to make trade-off and investment decisions prior to extensive and expensive hardware testing. This project's funding also allows AMSAA, as the Army's executive agent for the VV&A of item/system level performance models, to assist model developers in developing and executing verification, validation, and accreditation plans. Finally, this project finances AMSAA's role as the Army's Executive Agent for reliability and maintainability standardization improvement, wherein AMSAA develops and implements reliability and maintainability acquisition reform initiatives. As part of this mission, AMSAA develops and applies reliability-engineering approaches, including the Physics of Failure program, to assess the reliability of Army materiel and recommend ways to improve reliability, thereby reducing the logistics footprint, reducing life cycle costs and extending failure free periods for deployed equipment.

Chapter V. T&E Investment Strategy

A. Introduction

The number one priority for Army modernization investments is the development of the Future Force and particularly FCS, the foundation of the transformed Army. Initially that investment takes the form of S&T efforts to explore, identify, and develop the revolutionary technologies needed to make the FCS a reality. In addition to these S&T efforts, the Army is devoting a substantial and increasing amount of its RDA funding to fielding systems that will be fully integrated in the Future Force. Overall, maintaining effective interoperability between systems in the Current Force – including the SBCTs – and in the Future Force is a critical component of the Army's modernization plan. To accomplish this, sufficient resources will be applied to those activities that improve acquisition of interoperable capabilities across the force (e.g., areas such as architectures, training, C4 and ISR integration, and Software Blocking).

The Army has already begun this process by shifting investments toward fielding leap-ahead technologies needed for the Army of the future. The Army also intends to simultaneously insert many of the technological improvements into the Current Force as soon as reasonable to capture the benefits and improve near-term capabilities required for current operational readiness. This effort recognizes and includes supporting the CSA's REF initiative as discussed in Chapter I. Thus, our challenge is to ensure our T&E instrumentation and M&S capabilities are adequate to both support the GWoT, as well as the Army's Transformation.

B. Supporting Transformation

In order to realize the ATRMP vision and objectives stated in Chapter II and support the investment and modernization described above, the Army must evolve its traditional testing methodologies and capabilities to that of test and evaluation in a joint, capabilities-based context. This must be accomplished in such a way as to accelerate the fielding process of the Future Force and evaluate the effectiveness of a system of systems within the context of the unit of action. Tailored investments must be made in the T&E infrastructure in order to ensure that the personnel, ranges, facilities, and test capabilities are in place and ready to test, analyze, and evaluate Army capabilities as part of the joint force.

1. Background

Current Army acquisition policy as stated in AR 73-1 mandates T&E strategies that integrate all testing and modeling and simulation as an efficient continuum. Army T&E is now conducted as an iterative process that changes emphasis as a system evolves though design and fielding. The iterative use of

modeling and simulation and live tests supports the overall evolutionary design and development of a system. In the Army, this iterative process is called Simulation and Modeling for Acquisition, Requirements, and Training (SMART). In the SMART context, testing helps to validate system models, which are then immersed into synthetic environments to support the decision-making process. System models that are tested should be the same as, or traceable to, the models used for concept development, analysis of alternatives, system design, and production. Synthetic test environments may also be reused for training, operations planning and rehearsal, and subsequent concept developments. (Army Regulation 73-1, Jan 2002. p. 13)

The above policy is sufficient to describe the process that can and should be used to support streamlined testing, and therefore streamlined acquisition. However, until recently, the tools and capabilities were not available to support the implementation of this policy. This is changing. Since 1998, the Army has invested substantially in a capability called the Virtual Proving Ground (VPG), which is starting to pay dividends with a more complete implementation of SMART. The VPG effort is focused on developing a common architecture, common synthetic environments, integrated information systems and common tools for all Army test ranges (See Figure 5-1).

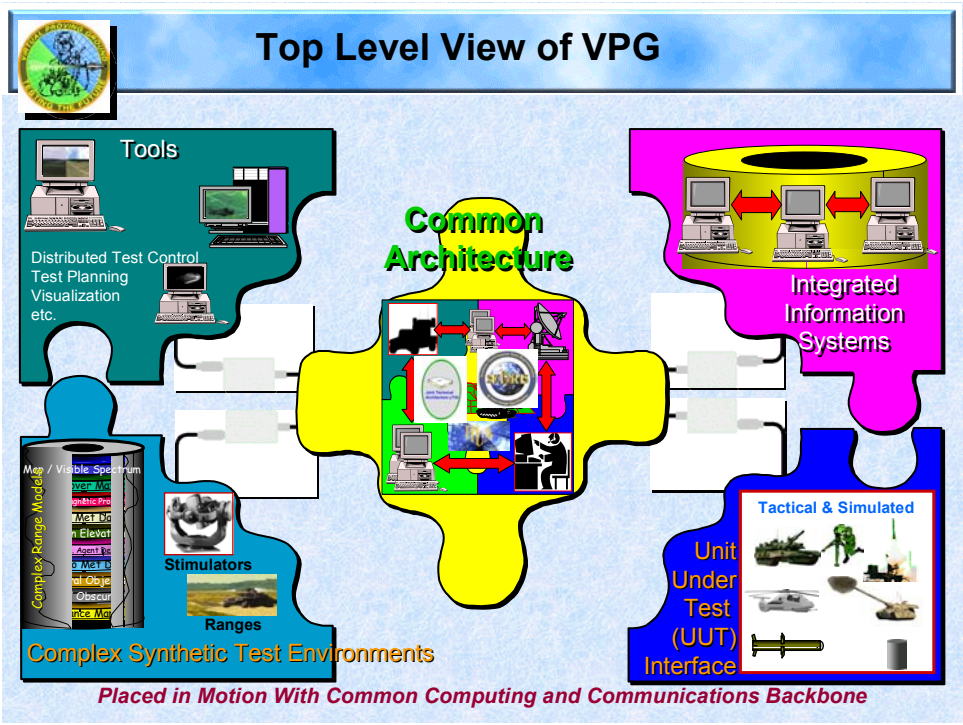


Figure 5-1 Top Level View of the Virtual Proving Ground Program

By establishing common interfaces, components and information systems throughout the Army's test ranges, we are now able to provide program managers with standard test interface control specifications which they can place in their requests for proposals, contract specifications and simulation support

plans. Many of these interface control specifications are published and are ready for use in the Future Combat Systems program, the Joint Tactical Radio System program, and others. This is a key step that allows systems to be designed for testability, whether in an M&S environment or a live hardware environment.

A major unknown up to this point has been the method for developing testable designs in an M&S environment. It is relatively easy to write such matters into policy, but difficult to put into practice. Over the past two years, Army testers and evaluators have been engaged in a dedicated effort to learn how to do this for the Future Combat Systems program, and we believe we have established a path forward that can be productively applied to all acquisition programs.

2. Testing Beyond the Platform

In April 2003, the *Department of Defense Transformation Planning Guidance* articulated a vision for future warfighting and military acquisition that transcends any particular acquisition program. Transformation is founded upon the strategic focus of network-centric operations, where virtually all acquisition programs must be capable of being "net-ready", i.e. having the ability to directly interoperate with all elements on the battlefield. Testing to ensure net-readiness is a level of testing beyond today's conventional platform performance testing. In the network-centric world, it is not enough to say that a platform meets or does not meet its specifications or local operational requirements. The issue that must be addressed is the potential *contribution* that a platform may make toward enabling a unit of action to accomplish its assigned mission. The Army has recently oriented its corporate evaluation strategy toward this end, as depicted by the example in Figure 5-2.

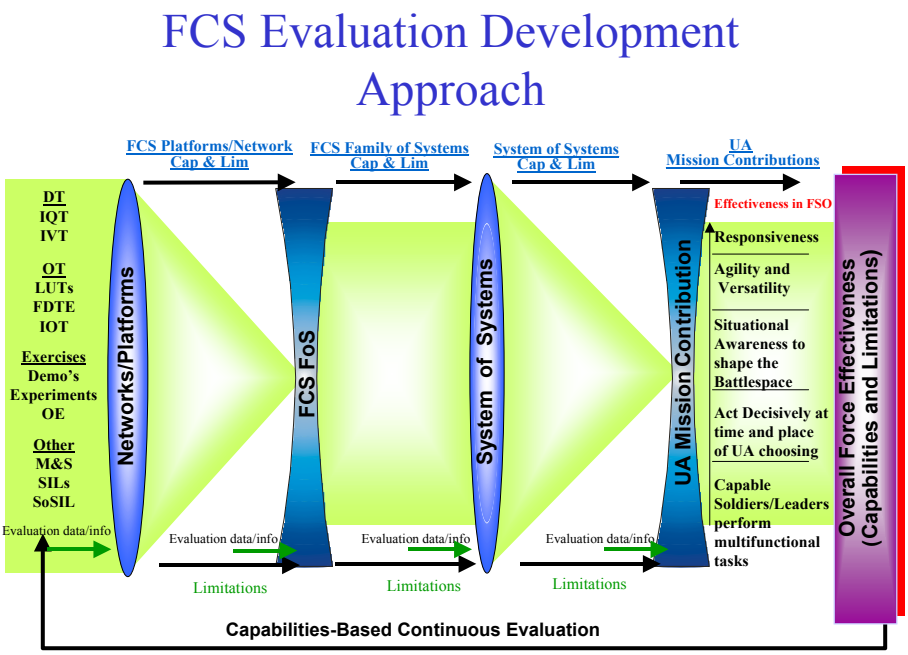


Figure 5-2 Evaluation Strategy - FCS Example

The evaluation strategy begins by looking at the overarching mission that the materiel in question is intended to support. By understanding the mission context for the equipment, testers and evaluators can craft a logical strategy that informs decision-makers of the relevant capabilities and limitations of the materiel as a function of its contribution to the mission. Thus, when developing a test and evaluation strategy for an acquisition program, you work from right to left, so that when the strategy is executed from left to right, the role of the components, subsystems and systems can be properly characterized with regard to mission effectiveness. This strategy is an enabler for addressing the *Transformation Planning Guidance*, particularly first pillar: Strengthening Joint Operations. The guidance specifies that it must involve integrated architectures.

> "Integrated architectures describe in greater detail the relationship between the tasks and activities that generate effects on enemy forces and supporting operations. They identify where operations intersect and overlap and they provide details on interoperability requirements. The architectures will include not just material solutions but also doctrine, organization, and training needs. Using these architectures, the JROC[Joint Requirements Oversight Council] will be responsible for prioritization of capabilities based on their contribution to realization of the JOCs [joint operating concepts]. (DoD Transformation Planning Guidance, April 2003. p.16)

3. DoD Architecture Framework

Linking integrated architectures to capabilities is not as difficult as it once was. This is due to the release of the *DoD Architecture Framework* (DODAF), in August 2003 (Figure 5-3, next page). This framework is very useful in two respects. First, it provides an adaptable format for describing operational, systemic and technical relationships for virtually any complex enterprise, and secondly, it is becoming widely used as a DoD standard. This implies that if one takes the time to think about their problem space and document their thinking using the DODAF framework, others will be able to understand their problem space and be able to assist in developing viable solutions. Operational views (OVs) describe the warfighters' operational requirements, the System Views (SVs) describe how capabilities meet these requirements and the Technical Views (TVs) describe the details of how the capabilities are to interact.

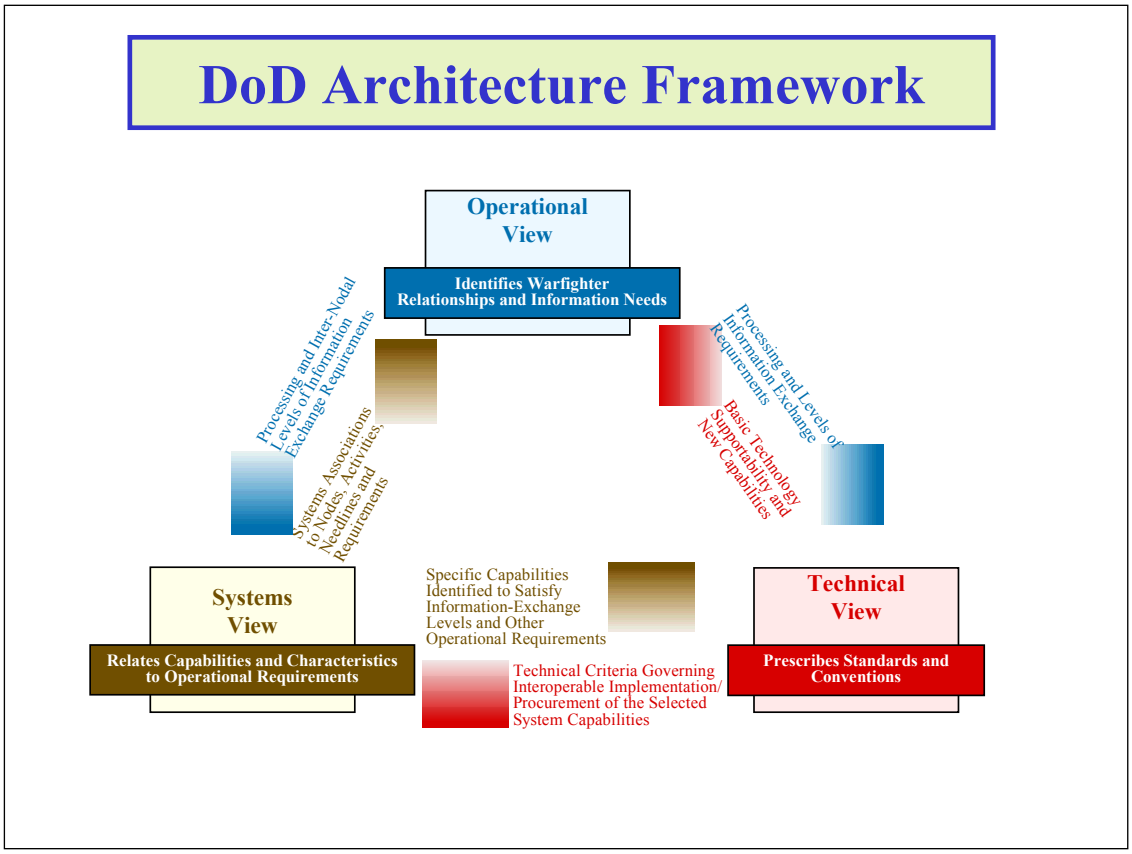


Figure 5-3 The DoD Architecture Framework

In essence, one can draw clear parallels between OVs and operational tests, SVs and developmental tests and TVs and performance specifications. Thus, if a program manager and his or her supporting test team choose to do so, they now have the tools and processes in place to perform a great amount of operational and developmental testing, not only before the end item is completed, but ideally, before the end item is even conceived. The time and money spent on detailed pre-planning of each aspect of a system's test program early in the acquisition cycle will avoid by orders of magnitude, the cost of building, testing and rebuilding and retesting hardware and software to achieve the same result.

In support of the Future Combat Systems development, the Army test and evaluation community, in partnership with TRADOC, the PM and the Lead Systems Integrator, has been engaged in executing this process. The Unit of Action Operational and Organization Concept has been decomposed and documented in DODAF compliant views. As a result of this effort, over eighty discrete "integrated processes," or IPs, have been identified as key enabling processes leading to unit of action mission accomplishment. Twenty-four of these have been identified as materiel-intensive, meaning that they are highly relevant processes for materiel evaluation.

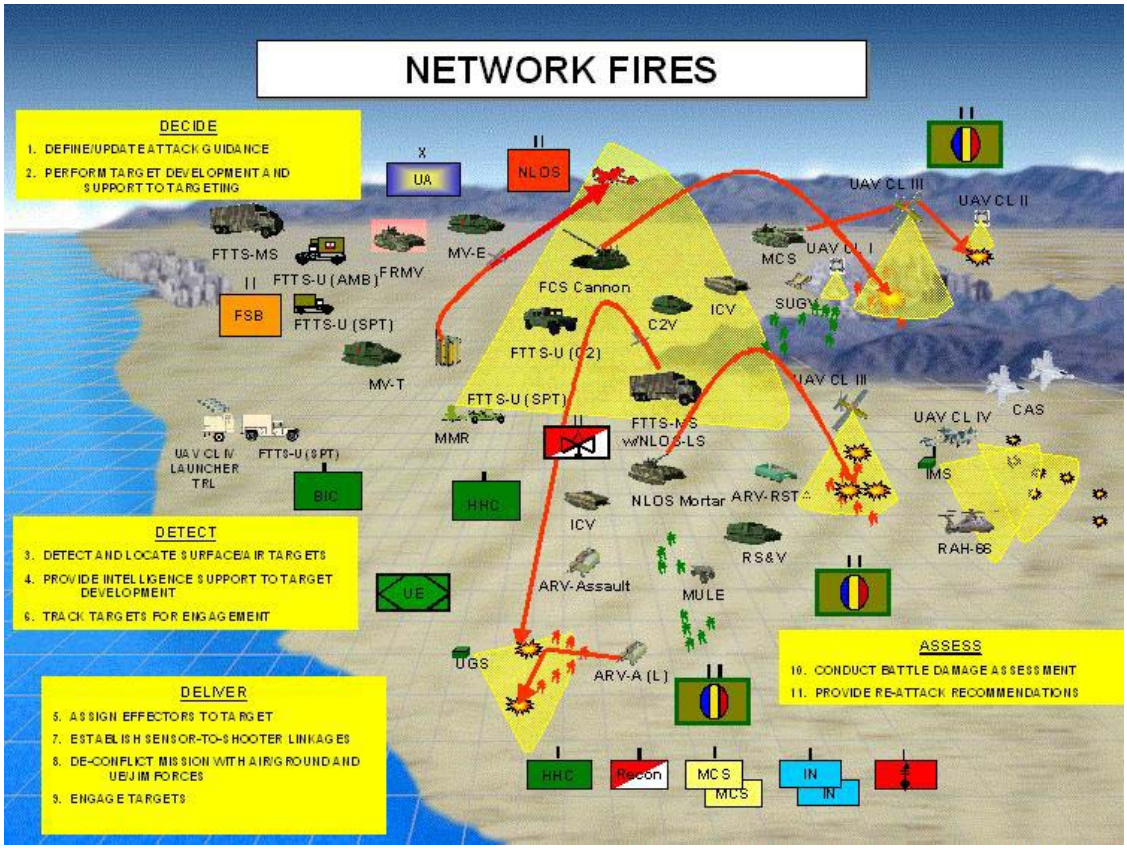


Figure 5-4 Operational View, Level 1, of a Unit of Action Integrated Process

Figure 5-4 provides an example of a DODAF-compliant operational view for one of these integrated processes. As the figure indicates, the intent is to identify the players and portray the relationships amongst the players in the vignette. Once this is done, the views can then identify the detailed interactions that need to take place, such as is shown in Figures 5-5 and 5-6.

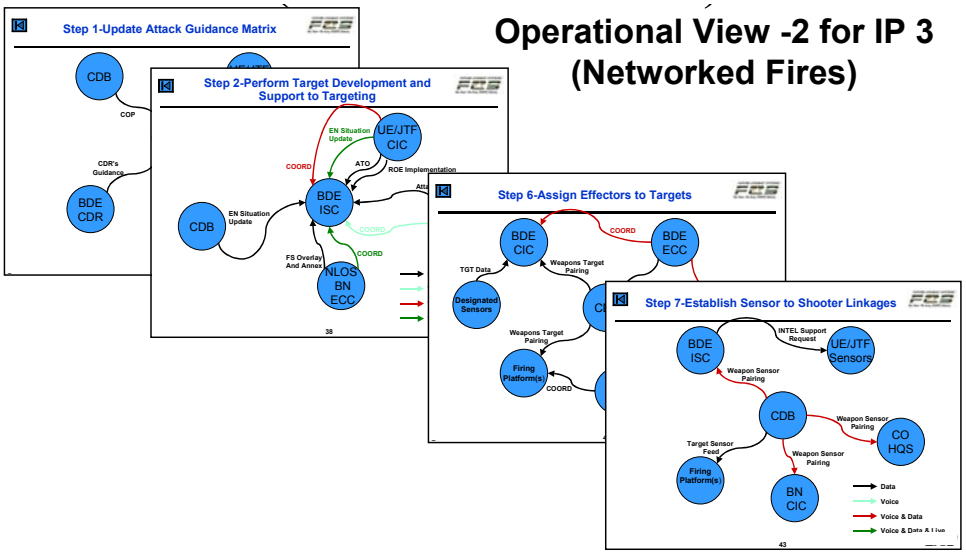


Figure 5-5. Operational View-2 of IP3

Operational View-3 (Networked Fires)

Integrated Process	Echelon View of the Process	Task Ref Number	Previous Step	Activity Name (Receiver Task)	Activity Description	Receiver Node	Receiver Echelon	Event	Information Characterization	Purpose	Sender Node	Sender Echelon
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	ROE Implementation	Provide Constraints	UE / JTF CIC	UE / JTF
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	Attack Guidance Matrix	Asset Management	UA FEC	BDE
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	COORD	Asset Management	UA FEC	BDE
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	EN Situation Update	Enemy Threat and Capability	DIDb	BDE
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	EN Situation Update	Enemy Threat and Capability	UE / JTF CIC	UE / JTF
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	EN Situation Update	Enemy Threat and Capability	UE / JTF CIC	UE / JTF
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	EN Situation Update	Enemy Threat and Capability	UE / JTF CIC	UE / JTF
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	FS Overlay and Annex	Asset Management	NLOS BN CIC	BN
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	COORD	Asset Management	NLOS BN CIC	BN
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	COORD	Asset Management	NLOS BN CIC	BN
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	COORD	Asset Management	NLOS BN CIC	BN
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	ATO	Asset Management	UE / JTF CIC	UE / JTF
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	COORD	Asset Management	UE / JTF CIC	UE / JTF
Networked fires	BDE	2	1	A4.3.2 PERFORM TARGET DEVELOPMENT AND SUPPORT TO TARGETING [ART 1.3.2]		UA ISC	BDE	Target Request	COORD	Asset Management	UE / JTF CIC	UE / JTF

Figure 5-6 Operational View 3 for IP3

These illustrations demonstrate how a functional decomposition of the problem can begin to elicit a solution. In this case, the test community is challenged to determine what infrastructure requirements it must meet in order to be sufficiently prepared to test any network-centric system, and most specifically the Future Combat System of Systems. A logical decomposition of the Unit of Action O&O Plan provides us the specific information exchange requirements that we must facilitate during testing, and therefore is leading to a test solution.

Extending this decomposition process to all of the materiel intensive IPs will guide the T&E community in identifying T&E solutions for the Future Force. The aggregated result must be included in the 21st Century Range concept as discussed later in this chapter.

4. Future Force Capabilities

The known capabilities needed to meet the goals of the Future Force are listed below:

- Improved sensors to see the full range of operational variables – terrain, weather, friendly and enemy force, noncombatants – and detect threat actions in all environments. Sensor-decider-shooter linkages at multiple levels will be networked horizontally and vertically to reduce latency and enable the most effective engagement of the enemy force.
- Improved precision munitions employing a broader range of effects with capabilities to loiter or be maneuvered in flight, enabling man-in-the-loop terminal control of precision effects even after launch.
- Advanced highly mobile fire delivery systems capable of operating singularly or in small groups to provide extended-range, internetted, and lethal and non-lethal precision and volume fires in support of operational and tactical maneuver. Future fire delivery systems must be enabled by highly

responsive fire control and reconfigurable C4ISR linkages to all relevant targeting systems and sensors.

- Improved operational force autonomy with reduced demand for fuel, spare parts, and munitions as well as system and platform advances in reliability and maintainability. Ultra-reliability has the potential for a particularly high payoff with respect to reduced logistical infrastructure, simplified maintenance, and sustained combat power.
- Advanced unmanned air and ground systems for reconnaissance, surveillance, attack, command and control (C^2), and other battlefield functions.
- Integrated lighter, more effective armor (composite materials) with active and passive protection systems to enhance survivability.
- Improved early warning and intercept of enemy ground- and air-launched conventional and smart weapons – missiles, rockets, cannon, and smart munitions.
- Improved tactical mobility that applies to the entire Future Force across all the battlefield functional areas. More tactically mobile sustainment platforms and capability for C^2 on the move are particularly critical to support high tempo operations.
- Improved warning of and defensive measures against nuclear, chemical, and biological hazards.
- Improved non-line-of-sight communications for use in restricted, urban, subterranean environments.
- Improved information protection for C^4ISR networks.
- Decreased sustainment demand across all classes of supply and services.

C. Army T&E Investment Strategy

Investing in T&E capabilities to support the Future Force is by far the greatest challenge for the T&E community. We must have a clear understanding of the technology thrust areas to allow us to study and eventually invest in those areas that will provide the necessary T&E support for the capabilities that will comprise the Future Force.

The Army's T&E infrastructure, as stated in Chapter III, consists of the personnel, facilities, ranges, installations, and tools required to perform the T&E mission in support of its customers. Investments must be made to sustain this infrastructure in order to provide the best possible support for the Army systems of today and the future.

The Army T&E Investment Strategy addresses each of the four ATRMP objectives as discussed in Chapter II. The following discussion addresses each

of the four objectives as they relate to the Army's T&E infrastructure. Objective one supports personnel aspects, whereas objectives two through four support the facilities, ranges, and tools aspects of the T&E infrastructure.

For each objective, the appropriate TST BOS PEs are listed (some PEs apply to more than one objective). Relative to objective one; maintaining a highly skilled workforce, manpower levels are shown based on projected workload.

1. Personnel

Objective 1: *Maintain a highly skilled, multi-disciplinary professional workforce capable of addressing tomorrow's technology demand.*

MDEP RL02:

665601/F30	Army Test Ranges and Facilities
665702/128	Met. Support to DTC Activities
665712/V02	ATEC Activities
665712/001	JT&E
122015	Combat Dev. Test Exper. & Instr.
665605/E97	DoD HELSTF
665801/M53	DTC Support
665301/614	U.S. Army Kwajalein Atoll

MDEP RL04:

665604/675	SLAD
665706/541	Materiel Systems Analysis
665716/302	Army Evaluation Center

MDEP RL07

122015	Combat Dev. Test Experim. & Instrument.

The foundation of the T&E infrastructure is the civilian, military and contractor T&E personnel who perform their tasks on the T&E ranges and facilities. The onset of advanced, automated test capabilities has reduced the dependency on human involvement in many of our T&E operations. However, the T&E requirements of the systems comprising Army Transformation has increased our workload beyond what was forecasted, and as a result there is a need for additional personnel to provide the necessary test planning, analysis, range operation, reporting and evaluating tasks required. Figures 5-7 through 5-12 illustrate the personnel levels (authorized and projected requirements FY03-FY11) for each of the commands and organizations within the T&E community.

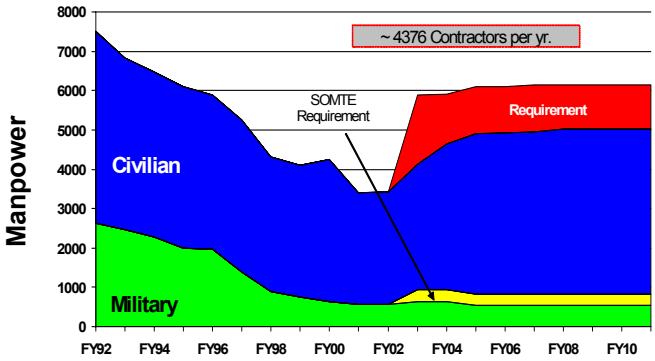


Figure 5-7. ATEC Manpower

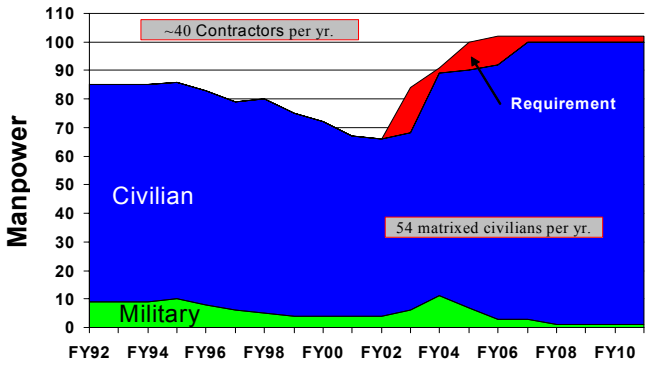


Figure 5-8. PM ITTS Manpower

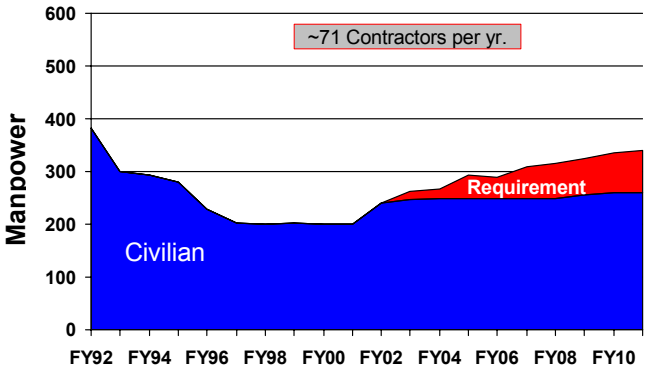


Figure 5-9. SLAD Manpower

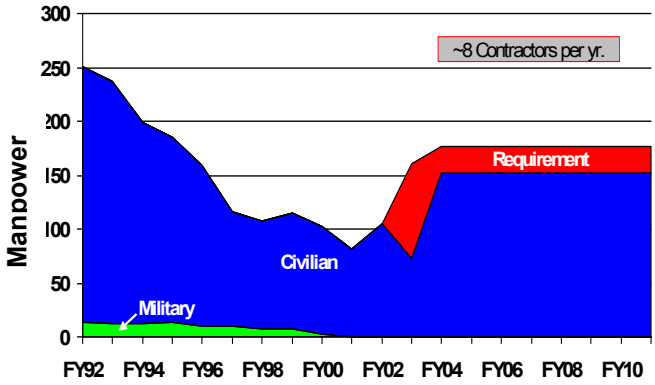


Figure 5-10. AMSAA Manpower

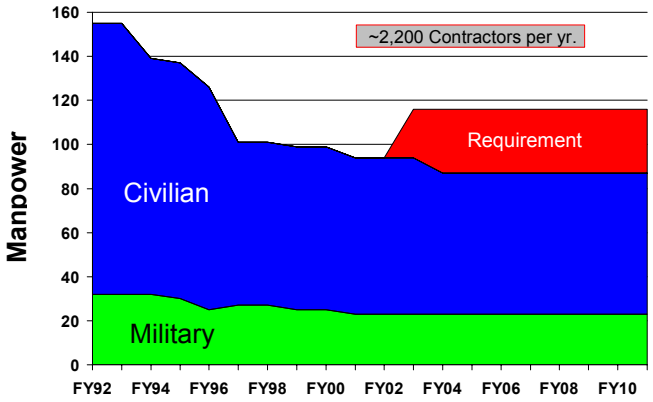


Figure 5-11. USAKA/RTS Manpower

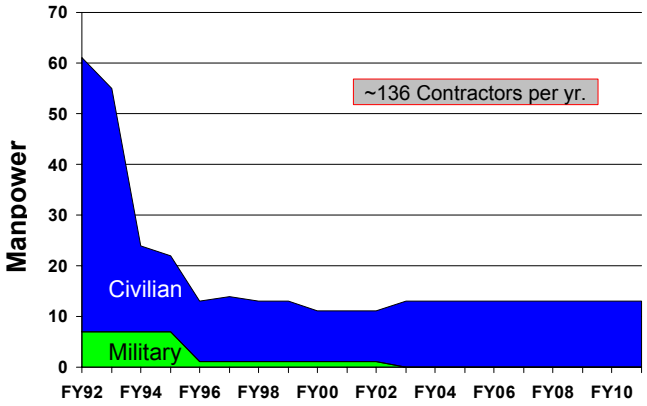


Figure 5-12. HELSTF Manpower

Management and procedural savings are not infinite; we must work to ensure that our thirst for efficiencies does not result in a less capable workforce deciding the fate of the next generation of weapons systems. Some priority personnel needs include the following:

- ***Technical personnel to research and develop future T&E capabilities***. The T&E infrastructure should lead weapons systems acquisition in both sophistication and technology.
- ***Expert engineers to ensure an adequate reliability component for every test event*.**
- ***Software professionals to evaluate software architecture and designs early in the development process*.** The testing infrastructure was designed around hardware, but software is now the critical component of modern weapons systems.
- ***Military personnel to provide direct user input*.** Military personnel, such as the Army's Soldier-operator-maintainer-tester-evaluators, are urgently needed back in the infrastructure so that systems can benefit from direct warfighter input during developmental testing. User participation has diminished as the emphasis on providing earlier feedback to the development process has increased.
- ***Technical expertise in specific areas***. These include flight safety systems, chemical and biological research, and mathematical and statistical analysis.

With the rapid advancement of technology, the complexity of new weapon systems and the environments in which they will be expected to operate means the rigor and sophistication of the T&E process must keep pace. The skill sets required to design and analyze tests of the next generation of weapons may not even reside within the present generation of workers, meaning that legacy skills will not suffice to meet future demands. The rapid infusion of breakthrough technologies into new as well as existing combat systems will be widespread. The Army must first identify and then recruit the skills necessary for the future. The following technologies represent what is likely to be required to field FCS, and therefore, represent a subset of technology skills needed in the Army T&E workforce:

- Software Programmable Radios
- Interface and Information Exchange
- Security Systems & Algorithms
- Mobile Ad Hoc Networking Protocols
- Quality of Service Algorithms
- Unmanned Systems Relays
- Wideband Waveforms
- Multi-Spectral Sensors & Seekers
- Decision Aids/Intelligent Agents
- Rapid Battle Damage Assessment
- Water Generation & Purification
- Computer Generated Forces
- Tactical Engagement Simulation
- Active Protection Systems
- Signature Management
- Lightweight Hull & Vehicle Armor
- Advanced Man-Machine Interfaces
- High Density Packaged Power

- Combat Identification
- Power Advanced Countermine Technologies
- Sensor/Data Fusion & Compression Algorithms
- Dynamic Sensor-Shooter Pairing Algorithms & Fire Control
- LOSBLOS/NLOS Precision Munitions Terminal Guidance
- Aided / Automatic Target Recognition
- Recoil Management & Lightweight Alloys
- Rapid Battlespace Deconfliction
- Distributive Collaboration of Manned / Unmanned Platforms
- High-Power Density/Fuel Efficient Propulsion
- Embedded Predictive Logistics Sensors & Algorithms
- Health Monitoring & Casualty Care Interventions
- Power Distribution & Control

In addition to the new skills required by new technologies, knowledge and skills in safety and environmental protection and remediation will increase in importance in the next 10 years. The Army must ensure the safe development, testing, and use of modern military weapon systems. The effects on the natural environment must be mitigated in balance with operational necessity.

There is an urgent need to replenish the Army T&E workforce with young "new thinking" T&E personnel, to develop and train them, and to assist them in structuring their careers to be able to compete for future management and supervisory job opportunities. Although the effort involved requires a significant amount of time and effort, it is nonetheless critical and urgently needed if our Army is to continue to produce the finest operationally effective, suitable, and survivable warfighting force in the world.

2. Facilities, Ranges, Installations and Tools

***Objective 2**: Develop advanced automated test data collection capabilities, and analytical and evaluation tools and methodologies.*

MDEP RL 02:

665605/E97	DoD HELSTF
665301/614	U.S. Army Kwajalein Atoll

MDEP RL07:

66475A/984	Major Technical Test Instrumentation
664759/986	Major User Test Instrumentation
664256/976	Army Threat Simulator Program
664258/238	Aerial Targets
664258/459	Ground Targets
MA6700	Special Equipment for User Testing
122015	Combat Dev. Test Exper. & Instr.
664759/983	Major T&E Investment USAKA

Objective 3: *Integrate Modeling and Simulation into the T&E process.*

MDEP RL07:

665602/628	Test Technology & Sustaining Inst.
664256/976	Army Threat Simulator Program
664258/238	Aerial Targets
664258/459	Ground Targets
665602/62C	Modeling & Simulation Inst.

***Objective 4*:** Modernize and sustain the core infrastructure and architecture to accommodate new and advanced capabilities developed from emerging technologies.

MDEP RL02

665601/F30	Army Test Ranges and Facilities
665301/614	U.S. Army Kwajalein Atoll

MDEP RL07:

665602/628	Test Technology & Sustaining Inst.
665602/62B	Operational Test Instrumentation Dev.

a. The 21st Century Range. The facilities, ranges, installations and tools portion of the T&E investment strategy is aligned with and supportive of the test solutions derived from the evaluation strategy discussed earlier in this chapter. The Army T&E Investment Strategy, like the Army transformation strategy, recognizes the need to recapitalize our current range capabilities, develop new capabilities to support near-term requirements, and transform our infrastructure to test the Future Force, and evaluate its contribution to the joint operations concept. This will be accomplished by implementing a strategy with an eye toward a cohesive, distributed end-state. This end-state is the 21st Century Range.

The 21st Century Range will be a distributed digital range that can not only rise to the demands of testing the Army's advanced systems, but also address the requirements of evaluating the unit of action capabilities as described in the evaluation strategy. The Future Force, and in particular the capabilities that will comprise the FCS, will be a networked force which will require a distributed test infrastructure to test and evaluate its capabilities. The 21st Century Range will provide real-time display; data fusion; mission visualization; improved customer data products; situational awareness; scene generation; distributed network access; and the integration of live, virtual, and constructive environments; all with improved efficiency and lower operational cost. Figure 5-13, on the following page, depicts the 21st Century Range.

Current Capabilities. Sustainment of existing capabilities poses a significant challenge for the 21st Century Range. Natural environmental factors and usage wear and tear cause complex and sensitive components to fail. These must be replaced, and over time the ability to replace these components

becomes more difficult and expensive due to obsolescence and short supply. Over the past ten years, test infrastructure sustainment and improvement has not been resourced sufficiently to keep pace.

Capabilities in existence today such as the FPS-16 range radar that are to be retained at their present level of capability or any other level of activity that requires sustainment activity, constitute the category of Current Capabilities. Current capabilities also includes equipment that is obsolete, requires no sustainment, and will be allowed to degrade and atrophy.

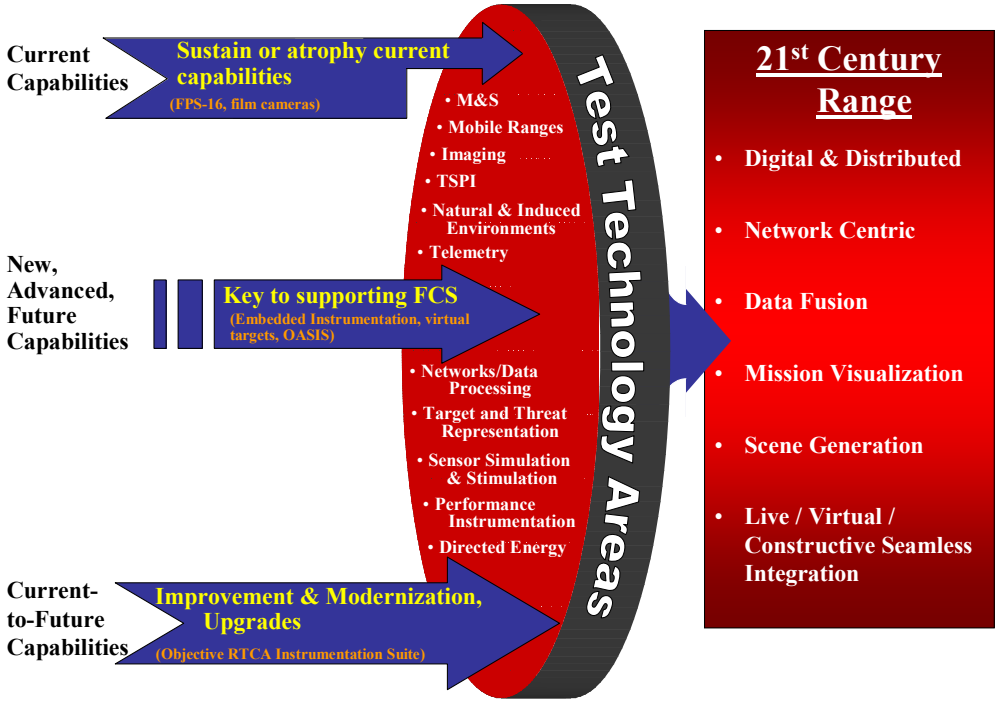


Figure 5-13. 21st Century Range

New, Advanced Future Capabilities. The Future Combat Systems are the centerpiece of the Future Force and represents a shift toward network-centric, rather than platform-centric family of capabilities. Thus the 21st Century Range must evolve toward providing a similar network-centric test capability that will enable capability-based testing and measure the contribution FCS will make to the joint operations concept, as opposed to a collection of discrete platform-centric test capabilities.

Elements of the network will include new test capabilities that are required to test the Future Force and the FCS that otherwise cannot be obtained by upgrading or modernizing an existing capability. An example of this is embedded instrumentation. The 21st Century Range will depend less on the philosophy of "hanging boxes on platforms" and more toward viewing itself as a "node on the acquisition network", whereby as part of the life cycle of a system (or family of

systems), the T&E community can "plug in" to the systems of interest to collect and process the required T&E data. The acquisition community and weapon system developers must work with the T&E community to design instrumentation directly into weapon systems that can collect and transport system data as part of a distributed network. This has far-reaching applications to the RDT&E community as well as the logisticians, who require supportability data on weapon systems as they operate in the field.

Another example is virtual targets. Virtual targets, which are digital representations of physical objects, can replace expensive, expendable aerial and ground vehicles. They can also be used and reused across multiple and distributed synthetic environments to achieve increased target density and allow system performance to be economically evaluated under much heavier target loading.

Current-to-Future Capabilities. As technology continues to advance, capabilities that are not improved become obsolete. Thus many of our current test capabilities and facilities, while previously considered state-of-the-art, are being overtaken by the advancement of the technologies inherent in the weapon systems currently under development. This poses the potential of a test facility becoming useless simply because it no longer applies to the technologies that require testing. Also, as technology advances, there may simply be better ways to get the job done.

Many of the T&E community's major test capabilities and facilities are the result of significant capital investment and are considered crucial in support of Army Transformation. However they require improvement, modernization, or upgrade to provide the required additional or improved capability to meet the needs of the systems being tested in the 21st Century Range. These capabilities will be essential in providing the required test support for the modernization of our current force and its integration into the future force. Capabilities such as the Operational Test Tactical Engagement System (OT-TES) represent test capabilities in this category.

Test Technology Areas. Guiding the development of our transformation to the 21st Century Range is a set of 11 test technology areas. These areas are linked not only to the technologies inherent in the weapon systems of Army Transformation, but also to the evaluation strategy reflected in figure 5-2. They guide the T&E community in developing its required test capabilities.

- **Imaging**

  Optical Imaging This test technology area includes optical instrumentation used in test operations. It ranges from high-speed film, high-speed digital video, advanced optical tracking systems such as cinetheodolites and Kineto Tracking Mounts (KTM) to Ultra high-speed (above 1 million frames per second record speed) digital imaging systems. Test data collection based on the use of imaging systems is used to provide threat and target interaction,

event miss distance, Time Space Position Information (TSPI) and phenomenology information on the subject environment. The media can range from film-based cameras to Ultra high-speed digital sensors. Different classes of camera systems provide images in the optical spectrum such as visible, infrared (IR), ultraviolet (UV) and X-ray. Cameras provide rates of capture from still photos to over 1 million frames per second in formats ranging from 16mm or equivalent, up to 70mm. Cameras are matched with lens systems to provide images of sufficient resolution to capture required detail and /or make measurements. Multiple systems are utilized to capture data from different aspect angles and the data records are combined in a data reduction process to define a full spatial and temporal record of the test. We are in the process of transitioning from traditional film-based systems to faster, high-resolution digital cameras, which will eliminate the requirement for film and provide a real time processing and analysis capability. Accommodations for this improved capacity must be made.

Electronic Imaging Electronic imaging is defined as Radio Frequency generated images. Historically electronic imaging systems have been utilized to capture real-time position information for use in flight safety and as an acquisition source for other instrumentation systems such as optics or telemetry. Recent developments in wideband RF transmitter technologies can provide accurate miss distance object deployment and damage assessment at extreme altitudes. Measurements from an Electronic Imaging system compare in resolution with optics measurements at low altitude and will far exceed optical imaging in the future, especially at longer ranges. The ability to track distant objects with greater resolution remains a goal under this test technology area. Other areas of concern are multi-band radars for multi-target angle data; ultra-high resolution radar for tracking distant objects, and advanced radar for ballistic trajectory measurements.

Image Processing and Analysis tools These tools are used to sort through massive amounts of imaging data to obtain essential information for test and evaluation. In many instances Terabytes of data per mission will be collected. Identifying the elements of interest will be accomplished through a variety of methods to include but not be limited to time correlation, event correlation and anomaly detection. Once the elements of interest are identified, various processing and analysis functions will be implemented. The analysis tools will support computer-aided detection and track of moving objects and provide position, size, shape, and intensity data as a function of time. An example is automatic detection and tracking of objects in which both changes of shape and direction occur against a complex background, as would be the case for a hypervelocity event or active protection impact.

- **Networks/Test Data Management and Processing**

Deployable, robust common network architecture is the lynchpin to test tomorrow's systems. This technology area provides the means of exchanging real-time information such as test control commands, data, and

stimulation and simulation information in live, virtual, and constructive environments. Wire (twisted pair and fiber optic), wireless-based, satellite, and aerial relay networks will provide a secure (encrypted), configurable and self-configurable, range-wide information transport system, which has affordable scalability and the ability to add transmission capacity and manage bandwidth. This state-of-the-art capability will provide transmission of data, voice, and video signals into a universal transport system. To enable system-of-systems testing, this common architecture will ensure interoperability among the ranges, facilities, and simulation/stimulation systems. In addition to common network architecture, an interoperable state-of-the-art hardware and software architecture is also required. A suite of tools is required to remotely control and monitor the instrumentation hardware and software. These tools have the ability to add, delete, configure, and display information concerning the instrumentation components. The network capability at field ranges will provide up-to-date equipment for range testing including, but not limited to, ATEC Test Integration Network (ATIN). The network capability will support joint testing, and to the extent possible, joint training between Services and coalition partners.

Test data management harvests, stores, archives, processes and displays data of all forms to: produce specific information products derived from that data in real-time or near-real-time (such as digital storage media); distribute data to associated local and remote systems via digital networks; provide raw data input to the post-test-data reduction process; and fuse, reduce and analyze the data and generate reports. Long term data archiving and management will facilitate data reuse.

- **Target and Threat Representation**

Test technologies of the future must include a seamless integration of live, virtual, and constructive simulation. In order to provide threat representations that support the total test picture of the future, we must provide open-air simulators and actual threat equipment that can be integrated into distributed simulation environments. Intelligent and adaptive threat capabilities must be portrayed for meaningful operational test environments. These environments must run the gamut from stability and support operations, to military operations in urban terrain, to major contingency operations. Threat models must include major military units, small insurgencies, increasing numbers and types of non-combatants, and forces that switch from friendly to enemy forces very rapidly. Electronic warfare (EW) is increasingly complex with the rapid growth of EW technologies. Realistic portrayal of EW and information operations both against, and by, the threat requires intelligent and adaptive reactions rather than simplistic responses.

Providing an appropriate threat environment for OT requires a combination of live red force (RedFOR) and M&S tailored to the system

under test. Tools must be created that permit a relatively small, live RedFOR to provide a realistically challenging opposition. Threat weapons and their tactical employment must be represented in order to adequately test future systems. The fidelity of these threat representations is also critical. Soldier performance in complex system-of-systems environments will be critically dependent upon the information available from networked sensors. Hence high fidelity simulations and stimulators to drive sensor feeds are fundamental to future OT and training events. The overall threat representation of tomorrow must be a complete, integrated force capable of operating in open air and simulated environments simultaneously.

Threats of the future will encompass the entire spectrum of military and non-military systems. Of particular interest are those systems which are threats to the Future Force, particularly threats to the blue concept of information dominance. This encompasses all aspects of integrated threat information operations such as C4I, intelligence, surveillance, and reconnaissance, information warfare, camouflage concealment deception & obscurants/countermeasures, and all their associated components and subcomponents, as well as other threat aspects such as weapons of mass destruction, maneuver and fire, air operations, air defense, special operations forces, and combat service support in a complex urban (civilian/commercial) environment. Along with these integrated systems and system complexes, the threat C3 systems must also be included to ensure the synergistic effects of their employment can be realized. The challenge for the T&E team (to include the intelligence community) is to determine the acceptable level of threat to be portrayed. What is the proper mix of actual and constructive threat representation and how can surrogates and simulators be used to effectively stress the system under test? Affordability is a key ingredient in the decision to assemble the proper mix of threat resources in support of testing. Therefore close coordination between the materiel developer, the tester, the evaluator, and the intelligence community will be required to achieve synergistically oriented efficiencies whenever possible.

The ability to accurately control the presentation of multiple targets and threats in live scenarios is critical. Implementation of tri-Service control technologies must be accomplished and sustained to provide this capability.

- **Mobile Range Technologies**

Mobile range technologies are those sensors, command and control and instrumentation that are transportable and can support multiple geographically dispersed test sites. In this age of distributed testing, joint test exercises and expanded performance envelopes of our weapon systems, testing will be conducted across various test sites. We must be able to transport our expanded instrumentation to fit the test site best suited to evaluate the system under test. Mobile range operations provide a solution to this challenge. Future developments must consider mobility and

transportability as an integral part of the requirement. We need to further develop enhanced range command, control, communications (C3), transportable radars for TSPI and RF signature data collection; transportable IR/visible optical systems for remote all-weather data collection; and mobile/transportable telemetry systems for remote and over-the-horizon data collection to support customers with know future requirements. The lack of required mobile range assets will overly restrict the test scenario, risk the loss of the critical data and limit the number of simultaneous tests necessary for milestone decisions.

- **Natural and Induced Environments**

The Future Force challenge to "see first, understand first, act first, and finish decisively…" explicitly underscores the necessity to properly and accurately portray the physical and environmental conditions to which systems under test will be subjected. Vibration, shock, Electromagnetic Environmental Effects (E3), High Altitude Electromagnetic Pulse (HEMP), nuclear effects, sand, dust, rain, humidity, and temperature are but a few of the environments we must be able to create. We must be continuously vigilant about maintaining, sustaining, and upgrading our capability to keep pace with the demands of the weapon systems of the Future Force. Areas of concern are replication of combined climatic environments, an artificial icing capability for rotary wing aircraft, and increasing E3 environments.

- **Sensor Simulation and Stimulation**

Sensors will play a vital role in the 21st century battle space for intelligence, surveillance, and reconnaissance (ISR), target acquisition and fire control, survivability warning sensors, and unmanned systems. The challenge to the test community will be to create the sensor simulation and stimulation capabilities to test advanced technology sensors such as radar, laser radar, millimeter wave, acoustic, seismic, magnetic, ultraviolet, visible, image intensified, infrared, laser, chemical/biological, and multi-spectral. In addition to individual sensor performance testing, test capabilities are required to test new technologies such as sensor fusion, aided target detection, automated target recognition, and aided piloted systems. Test capabilities are required for developmental and operational testing of individual and distributed sensors, sensor interoperability testing, installed sensor integration testing, and field testing of sensors.

- **Performance Instrumentation**

Performance instrumentation consists of sensors, transducers, signal conditioning, direct interfaces to systems under test, on-board storage, and radio or telemetry interfaces to support remote monitoring, control, stimulation and data collection. Performance data covers a wide variety of information such as, Force-on-Force RTCA, war fighter performance, integrated vehicle data bus messages, collection of digital communication

(C4ISR) traffic, temperatures, pressure and strain gage measurements, complex control system monitoring, as well as various parameters to support RAM determinations.

Efforts and investments are toward development and expansion of commonality and interoperability among a large inventory of instrumentation for application across all phases of testing (e.g. DT, LUT, OT). The improved commonality and interoperability of instrumentation will result in resource sharing among test organizations, reduced test costs as designs and installations are shared across the test phases, and ability to readily mix various instrumentation functions with reduced size, weight and power. Common standards for instrumentation greatly facilitate the combined use of embedded instrumentation (built into new systems) and added instrumentation configured for each test requirement.

As new Army systems become more complex, the ability to adapt and interface test instrumentation becomes increasingly challenging. Complex systems with stringent size, space, and power limitations mandate use of embedded performance instrumentation. Robotic systems, land warrior systems, and UAVs are examples that will be extremely difficult to adequately test without embedded instrumentation capabilities. Other applications are for the next generation of munitions that include thrust vector control or loitering munitions with autonomous target discrimination. Processes will be developed for verification and calibration of embedded instrumentation. Instrumentation commonality and promotion of requirements for embedded instrumentation with standardized interfaces will greatly facilitate future testing.

Future test environments will require larger battle space and more participants than can be supported in the “safe” confines of existing test and training ranges and within reasonable cost constraints. Smaller live forces must be used as part of a larger force structure and robust environment to appropriately challenge and stimulate the smaller live play battlefield. RTCA must be extended to operate beyond current capabilities to instrument live players in a constrained operational space. In order to assess operational performance in a larger force structure and robust environment, live RTCA will be linked to virtual and constructive simulations to appropriately challenge and stimulate the smaller live play battlefield. The synthetic battlefield and robust environment are to be accomplished with accredited models and simulations with the necessary links among the M&S components and the live play arena.

- **Directed Energy Technologies**

Directed energy (DE) programs include lasers (low to high energy), high power microwaves (narrow to ultra-wide band), and particle beams. Recent successes in S&T investments in DE programs have shown the potential for their inclusion in the Future Force FCS variants (Enhanced Area Air Defense System (EAADS) and space control). Development of the mobile the

Tactical High Energy Laser (THEL) and solid-state laser programs are currently funded. The current DE infrastructure must undergo some significant transformation to prepare for DT, OT, and LFT for these HEL weapons and high power microwave (HPM) sources as they proceed through their acquisition cycle. In addition to mobile and transportable diagnostics capabilities, the Army must pursue upgrades and replacements to its current DE monitoring systems to provide open architecture that will accept a wide variety of HEL and HPM systems undergoing testing. To ensure future HEL T&E, development of a readily mobile beam director that has switchable/broadband optics and new automated support systems that will provide quick data reduction, data analysis, and force-on-force level M&S support is required. All DE T&E upgrades should include blue on red and red on blue capabilities, and fratricide issue resolution.

- **Modeling and Simulation**

Modeling and simulation is essential for robust and cost effective test and evaluation. System performance of highly dynamic, network centric systems must be accurately simulated and appropriately stimulated in order to plan and execute a test in realistic environments and under optimal support conditions. Technology advancements, particularly in the area of computing capabilities, provide powerful M&S tools to complement and improve testing, and to support evaluation. This technology area covers M&S for test support from requirements generation and concept design through execution and evaluation. It includes both the modeling of the system under test, interacting with other platforms in a system of systems environment, as well as the synthetic environment representing environmental effects and stimuli to both live and virtual systems under test. Testers and evaluators of equipment need both a thorough understanding of the system under test, and an understanding of how to best use the tools available. Many new systems are becoming so complex that the only way to provide a realistic test environment is through simulation (either through augmentation or enhancement of the physical test ranges or by providing the environment completely through simulation). A collection of models under development will cover the full range of required complex synthetic environments. A specific wrap-around environment is created by linking various M&S components into a complex, realistic synthetic environment. To satisfy requirements of a specific test, all relevant features and characteristics of the natural and manmade elements of the synthetic environment must be represented. This includes digital terrain, human (soldiers and non-combatants), weather and atmospheric effects, propagation, signatures, disturbance environments, virtual battlespace, simulators and stimulators.

Development of the test and evaluation M&S capabilities is conducted in partnership with other major simulation programs, such as One Semi-Automated Forces (OneSAF) and other architectures, such as TENA. T&E requirements are presented to the other programs and M&S developed by other programs are integrated in the T&E simulation capabilities. Distributed

M&S tools and capabilities provide the foundation for building the distributed 21st Century Range necessary to test the future Army system of systems in a network-centric environment.

- **Telemetry**

Telemetry is the direct collection of data on the test article, and transmitting, receiving, recording, processing, displaying and archiving of that data. This data is then multiplexed and transmitted to a receiving system and data processor for retrieval. Some examples of information gathered are weapon sensor images, temperatures, electrical checks, guidance status, TSPI, health/status, event and dynamics. The information is both recorded for further analysis and displayed in real-time for use by safety and mission control. Increased data rates and information content have required the stretching of bandwidth to accommodate the expansion of requested data. Similar to imaging, telemetry will require its corresponding processing and analysis tools.

- **Time, Space, Position Information (TSPI)**

TSPI is the measurement of test article location with respect to time. TSPI is obtained through both internal (e.g. GPS, translator, inertial measurement unit, inertial navigation system) and external sources (e.g. radar, optical, and interferometer). With the development of hypervelocity projectiles and long range TSPI tracking, there is a need for real-time fusion of classical TSPI sources. Such technology will provide TSPI of kinetic energy and direct-fire trajectories. A capability is also required to track multiple objects during testing of active protection systems and GPS denial environments and would require redundancy to mitigate track dropouts. Further, the capability should be mobile for optimum placement and transportability to remote locations for full spectrum environmental conditions. Similar to imaging, TSPI will require its corresponding processing and analysis tools.

b. Combining Test and Training Infrastructure and Events. The operational tempo of today's Army limits availability of soldiers to conduct exercises dedicated to operational testing of new equipment. The need for new equipment to be tested in realistic environments prior to fielding will make it increasingly necessary to find ways for exercises to meet multiple requirements, such as unit training, mission readiness certification, and operational testing. Increased levels of coordination will be required between test and training proponents for both investments in capabilities and operational planning for events.

Operational testing and training requirements do not have to be mutually exclusive. Joint exercises using Joint National Training Capability (JNTC) and training at the Army's Combat Training Centers (CTCs) offer robust operational events where test objectives can be addressed. Investments to control necessary elements, inject specialized stimulation, and capture necessary data

can make training exercises appropriate venues for operational testing. These large events can render data useful for both testing and training purposes. In addition, OT will often require events to be conducted at locations other than CTCs. The capability must be transportable.

Operational testing has a requirement for force-on-force testing to create a realistic battlefield engagement effects termed Real Time Casualty Assessment (RTCA). Similarly, a major component of Army live training is a Tactical Engagement Simulation System (TESS). The training requirement is for higher fidelity and extended capabilities that current TESS systems can adequately address. Army TESS and RTCA are merging in the Army's OneTESS development with IOC expected prior to FY12. Extending realistic RTCA/TESS to joint exercises and continuing to enhance the Army's OneTESS to depict new weapons, platforms, and capabilities will be required. The first exposure of the new capabilities is for testing, and these investments for adaptation and validation for new engagement methods can be transitioned to training applications. Rigorous configuration management of methodologies will be required between the test and training communities to maintain engagement model accreditation integrity.

Changing other systems, such as Electronic Warfare and Information Operations Modeling and Simulation and Instrumentation capabilities, to fully support both training and testing will be critical, as well as adding appropriate methodology to represent new technologies such as non-lethal weapons. Additional digital and video collection capabilities will be required for T&E and will be able to supplement training capabilities.

Detailed modeling of urban terrain is required for the operational testing of system of systems for many major future tests. Urban training facilities must be digitized and represented in the constructive simulations being used for test and training events. Constructive military units must face the same constraints and difficulties of urban terrain as their live unit counterparts. These technologies include, but are not limited to, line of sight and communication propagation models, dynamic terrain characteristics, and sub-terrain modeling.

Operational environment extensions and enhancements are provided by "wrap-around" synthetic environments - models that provide the basic environment for testing, regardless of test design and data collection requirements. Each environment requires a digital terrain, weather, and propagation models along with some representation of friendly, enemy, and neutral forces. Models used for wrap-around environments should have a high degree of reusability for testing and training. Specific test requirements will drive the level of fidelity required for each of these models, but with proper requirements definition and model design, reusability is greatly enhanced. Future semi-automated forces (SAF) simulations should be designed with this capability built to the levels of fidelity required by the most stringent users, usually the operational testers. The wrap-around environment includes synthetic automated generation of realistic messaging and information that should

eventually include all aspects of the battlefield management to include intelligence and logistics reporting.

3. ATRMP Roadmaps

a. Test Technology Roadmap. The following Test Technology roadmap details current Army requirements related to the 11 technology areas that are used to describe the 21st Century Range. Technology areas and program names are listed on the left. The years a program requires development funding are indicated in dark gray. Light gray indicates the expected years for program sustainment. It is assumed that a new capability will be realized and available for use at the end of a program's development cycle. Upon completion, the continued support of that capability would by transferred to sustainment, until no longer needed. Black arrows showing connections between various projects indicate a potential progression to a new more advanced technology. These roadmaps should be the starting point for development of the FY 07-11 POM. Current programs will be reviewed for their continued applicability and adequacy. The roadmaps are not meant to be all-inclusive or mutually exclusive.

Test Technology Roadmap

Ref No.	Technology	FY05	FY06	FY07	FY08	FY09	FY10	FY11
1	**Imaging**							
1.1	***Optical Imaging***							
1.1.2	Digital Video Systems Standards Development (DVSD)							
1.1.3	FCS Video Data Collection (Link to Embedded Instrumentation 7.10)							
1.1.5	High Altitude Intercept Imaging System (HAIIS)							
1.1.6	FCS Battlespace Real-Time Video							
1.1.7	Film to Digital Video							
1.1.8	Film to Digital Migration							
1.1.9	Transportable IR Optical Sensor (TIROS)							
1.1.11	Optics Tracking System Upgrade							
1.2	***Electronic Imaging***							
1.2.1	RF Imaging System							
1.2.2	Radar Waveform Testbed							
1.2.3	Ultra Wide Band Imaging Upgrades (UWB)							
1.2.4	Multi-Band, Multi-Aspect Imaging							
1.2.5	Advanced Digital Radar Suite							
1.3	***Image Processing and Analysis Tools***							
1.3.1	Electronic Image Processing							
2	**Networks/Data Management**							
2.1	Test Support Network							
2.2	Range Digital Transmission System							
2.3	Fiber Optic Network II – ATC							
2.4	STARSHIP							
2.5	STARSHIP II/C4I Test Instrumentation Control Center (TCC) II							
2.6	STARSHIP III							
2.7	Foundation Initiative 2010							
2.9	Instrumentation Communication Aerial Relay							
2.10	Encrypted Data Transfer Capability							
2.11	Mobil Ad Hoc Network (MANET)							
2.12	Versatile Information System, Integrated, Online (VISION)							
2.13	ATEC Test Integration Network (ATIN)							
2.14	FCS Test Network Data Collection and Security							
2.15	21st Century Range Network Architecture for Distributed Testing							
2.16	InterTEC							
2.17	Central Operation of Telemetry Assets (COTA)							
2.18	Data Management							

Test Technology Roadmap

Ref No.	Technology	FY05	FY06	FY07	FY08	FY09	FY10	FY11
2.19	FCS Standardized Platform Interfaces							
2.20	Range Operations Coordination Center Modernization (ROCC)							
2.21	Digital Network Migration							
2.22	High Capacity Archival							
2.23	LAN/WAN Implementation Project (LIP)							
2.24	Range Radio Mission Support (RRMS)							
2.25	RTS Kwajalein Atoll Terminal Upgrade (RKTU)							
2.26	Communications Definity G3 Upgrade							
2.27	RTS-GIG Bandwidth Expansion (RTS-GBE)							
2.28	Kwajalein/Meck/Roi Bandwidth Expansion GBE							
2.29	Joint Interoperability Test Analysis Capability							
2.30	DTE-4 /SEIT							
2.31	RTS Network Operations Support Center (NOSC)							
3	**Threats and Targets**							
3.1	***Threat Simulators***							
3.1.1	Integrated Threat IO							
3.1.1.1	- Threat IEW							
3.1.2	- C4I							
3.1.2.1	- Advanced-Electronic Order of Battle							
3.1.2.2	- TOS Range							
3.1.2.3	- Threat Tactical Engagement Network							
3.1.2.4	- Threat Dense Environment Radio Frequency Injection (DERFI)							
3.1.2.5	- Data Fusion RSTA							
3.1.3	Intelligence Security & Reconnaissance							
3.1.3.1	- Radar Surveillance & Target Acquisition							
3.1.3.2	- IEW Test and Operations Center							
3.1.3.3	- UAV Payload							
3.1.3.4	- Threat Aerial Recon System							
3.1.3.5	- Threat Unattended Ground Systems							
3.1.4	Information Warfare							
3.1.4.1	*Electronic Warfare*							
3.1.4.1.1	- All-in-One Jammer							
3.1.4.1.2	- Next Generation Communications Jammer							
3.1.4.1.3	- Advanced GPS Jammer							
3.1.4.1.4	- Advanced Signal Injection Jammer							
3.1.4.1.5	- Threat EO/IR Jammer							
3.1.4.2	*Computer Network Operations*							
3.1.4.2.1	- Information Assurance Test Tool (IATT)							
3.1.4.2.2	- IATT Wireless							

Test Technology Roadmap

Ref No.	Technology	FY05	FY06	FY07	FY08	FY09	FY10	FY11
3.1.4.2.3	- Advanced IATT							
3.1.4.3	Signals Intelligence/Direction Finding							
3.1.4.3.1	- Threat DF System							
3.1.5	Camouflage Concealment Deception & Obscurants/Countermeasures							
3.1.5.1	- Threat Deception Techniques							
3.1.5.2	- XM Mines							
3.1.6	Maneuver and Fires							
3.1.6.1	- XMATGM-A							
3.1.6.2	- ATGM M&S							
3.1.6.3	- Advanced Top Attack							
3.1.6.4	- XMAPS M&S							
3.1.6.5	- Threat DEW							
3.1.6.6	- Threat Plume Emulator							
3.1.7	Threat Air / Air Defense							
3.1.7.1	- XM-11S#1							
3.1.7.2	- Threat Air Defense Simulations							
3.1.7.3	- Advanced Laser Beam Rider SAM System							
3.1.7.4	- Advanced SAM Radar							
3.1.7.5	- Advanced MANPADS							
3.1.7.6	- Threat ADA M&S							
3.1.7.7	- Next Gen AAA							
3.1.7.8	- Man-in-the-Loop Virtual Threat Simulator							
3.1.7.9	- Threat Helicopter							
3.1.8	Other							
3.1.8.1	- CBRN							
3.1.8.2	- IMASE Scenario Generation Tool (ISGT)							
3.1.8.3	- Next Generation ISGT							
3.1.8.4	- Threat Systems Instrumentation							
3.1.8.5	- Threat Operations							
3.1.8.6	- Threat Systems Intel Upgrades							
3.1.8.7	- TENA Compliance							
3.1.8.8	- Threat ADA Sustainment							
3.1.8.9	- DoD Information Technology Security Certification & Accreditation Process (DITSCAP)							
3.2	***Targets***							
3.2.1	Aerial Virtual Targets							
3.2.2	Ground Virtual Targets							
3.2.3	Towed Targets / Ancillary							
3.2.4	MQM-107 Targets							
3.2.5	Unmanned Aerial Vehicle Targets							

Test Technology Roadmap

Ref No.	Technology	FY05	FY06	FY07	FY08	FY09	FY10	FY11
3.2.6	Mobile Ground Target Operations							
3.2.7	Rotary Wing Targets							
3.2.8	Main Battle Tank Surrogate							
3.2.9	Mobile Ground Targets Surrogates							
3.2.10	Threat Mobile Ground Targets							
3.2.11	Target Control System/Subsystem							
3.2.11.1	- Integrated Avionics Program							
3.2.11.2	- Target Tracking & Control Station							
3.2.11.3	- 21st Century Target Control System							
3.2.11.4	- Airborne Control Subsystem for Rotary Wing Targets							
3.2.12	- Aerial Target Operations							
4	**Mobile Range Operations**							
4.2	Mobile Range Command, Control, Communications							
5	**Natural & Induced Environments**							
5.1	Joint Fire Survivability Test Instrumentation							
5.2	Helicopter Icing Spray System (HISS)							
5.3	Large Capacity 6 DOF Motion Replication							
5.4	Electromagnetic Environmental Effects Test Enhancement							
5.5	CB Dynamic Stimulator							
5.6	HEMP Testing							
5.7	Nuclear Radiation Environment Enhancement							
5.8	Installed Systems Susceptibility Test Capability							
5.9	Test Site/Natural Environments Characterization							
5.10	Unmanned Ground Systems Baseline Performance Test Course							
5.11	Non-contact Terrain/Test Course Severity Measurement System							
6	**Sensor Simulation & Stimulation**							
6.1	Multi-signature Moving Target Simulator (Ground)							
6.2	IRSS LFRA Development (CTEIP)							
6.3	Objective MIRSP							
6.3.1	- Multi-Spectral Subsystem Stimulator							
6.3.2	- 1024x1024 Mobile IR Projector Stimulator							
6.4	Advanced Multi-spectral Sensor and Subsystem Test Capability(AMSSTC)							
6.4.1	- Advanced Multi-spectral Simulation, Test, Acceptance Resource (AMSTAR)							
6.4.2	- MMW Range Characterization /Virtual Range Development							

Test Technology Roadmap

Ref No.	Technology	FY05	FY06	FY07	FY08	FY09	FY10	FY11
6.4.3	- Distributed Testing							
6.4.4	- EO Sensor Laboratory Test Enhancement							
6.4.5	- Environmental Testing							
6.5	Dynamic IR Scene Projector P3I							
6.6	Aviation Multi-Spectral Test Capability							
6.6.1	- Advanced IR (3rd Gen, SWIR)							
6.6.2	- Ultraviolet							
6.6.3	- Radio Frequency							
6.6.4	- Image Intensified							
6.6.5	- Millimeter Wave							
6.6.6	- Visual							
6.6.7	- Enhanced Pilotage							
6.7	Next Generation Sensor/Stimulator Technology Test Enhancement							
6.8	Advanced Digital Sensor Modeling							
6.9	Sensor Data Collection							
6.10	Beam Steering Device for MIRSP							
6.11	MIRSP Wide Format Resistor Array P3I							
6.12*	Chemical Avoidance Detection Test Suite							
7	**Performance Instrumentation**							
7.1	Roadway Simulator							
7.2	High Speed Light Mobile Dynamometer							
7.4	Operational Test – Tactical Engagement System (OT-TES)							
7.5	OT-TES for FCS							
7.6	ONE-TESS							
7.7	Autonomous Control of Vehicles							
7.8	VISION (Perform. Instrumentation)							
7.9	Hardened Subminiature Telemetry and Sensor System							
7.10	Embedded Instrumentation Suites							
7.11	FCS Vehicle Digital Data Collection							
7.12	FCS Sensor Data Collection							
7.13	C4I Test Bed							
7.14	Remotely Reconfigurable Intelligent Instrumentation to Control, Collect, Simulate and Stimulate (RICS)2							
7.15	RF Receiver Modernization (RRM)							
7.16	Joint Warfighter Test Suite							
7.17	FCS Physiological Instrumentation							
7.18	FCS Soldier Data Collection							
7.20	Static Missile Propulsion Test Capability Enhancement							
7.21	Next Generation Munitions Test Suite							

Test Technology Roadmap

Ref No.	Technology	FY05	FY06	FY07	FY08	FY09	FY10	FY11
7.22	Land Sea Vulnerability Test Capability							
7.24	System Test & Integration Laboratory (STIL)							
7.25	Embedded Pressure Transducer							
7.26	Multispectral Ground Truth Signal Monitoring System							
7.27	Physical Properties Measurement enhancements							
7.28	Aviation Transmission Test Facility							
7.29	High Speed Data Recording System							
7.30	Air Transport Instrumentation System							
7.31	Alternative Power Systems for FCS Testing							
7.32	Large Capacity 6 DOF Motion Replication							
7.33	Precision Engagement Instrumentation for FCS							
7.34	Detection Transformation Test Suite							
7.35	Advanced Logistics Transformation Test Capability							
7.36	Advanced Armor Protection Instrumentation							
7.37	Transmitter Reliability Improvement Program (TRIP)							
7.38	MMW Performance Enhancements (MPE)							
7.39	Kwajalein Missile Impact Scoring System (KMISS)							
7.40	TRADEX S-Band Sensitivity Improvement (TSSI)							
7.41	TRADEX Feed Horn Upgrade (TFHU, previously TDBF)							
7.42	Integrated Vertical Profiler (IVP)							
7.43	MPS-36 Sensivity Enhancement (MPSE)							
7.44	Common Antenna Motor Control Program (AMC)							
7.45	GBR-P/RTS Integration Project (GRIP)							
7.46	Worthy Sensor Upgrades (WSU)							
7.47	Range Safety System Upgrade							
8	**Directed Energy**							
8.1	HELSTF Tactical HEL Beam Director/BMC4I Testbed							
8.2	HELSTF Control System Modernization							
8.4	HELSTF Technology Improvements							
8.5	HELSTF Mobile HEL Diagnostic System							
8.7	Directed Energy Test and Evaluation Capabilities							
9	**Modeling and Simulation**							
9.1	Virtual Proving Ground (VPG)							
9.1.1	- Architecture Framework							
9.1.2	- Distributed Simulation Services							

Test Technology Roadmap

Ref No.	Technology	FY05	FY06	FY07	FY08	FY09	FY10	FY11
9.1.3	- Simulation Infrastructure							
9.2	VPG Integrated Information Systems (IIS)							
9.2.1	- Integration Level Hierarchy							
9.2.2	- Test Center IS Integration							
9.3	VPG Tools							
9.3.1	- Test Planning							
9.3.2	- Test Execution and Control							
9.3.3	- Test Analysis and Reporting							
9.4	OASIS							
9.4.1	- OASIS Integration							
9.4.1.1	-ENS Pilot							
9.4.2	- IMASE							
9.4.2.1	- ISSS							
9.4.2.2	- ISGT							
9.4.2.3	- ISIS							
9.4.3	- STORM							
9.4.4	- STORM FCS							
9.4.5	- EXCIS-FSA							
9.4.7	- Logistics Driver							
9.4.8	- ADASIM							
9.5	Synthetic Environments VPG/OASIS							
9.5.1	- Human System Integration							
9.5.2	- Digital Terrain							
9.5.3	- Weather/Atmospheric/ Sensor Effects							
9.5.4	- Propagation Models							
9.5.5	- Signatures							
9.5.6	- Disturbance Environments							
9.5.7	- Virtual Battlespace							
9.5.8	- Stimulators							
9.5.9	- NBC Environment							
9.5.12	- C3 Driver							
9.5.13	- RTCA LVC - Interface							
9.5.14	- OT Synthetic Environment Lab							
9.6	Quantitative Visualization (QV)							
9.7	Joint EM Propagation Modeling System (JEMPMS)							
9.8	OneSAF (Test & Training Integration)							
9.9	Enterprise Nervous System (ENS)							
9.10	Reconfigurable Cockpit Simulator							
10	**Telemetry**							
10.2	Extended Range Support Telemetry(ERST)							
10.3	Develop Enhanced RTS Telemetry (DERT)							

Test Technology Roadmap

Ref No.	Technology	FY05	FY06	FY07	FY08	FY09	FY10	FY11
11	**Time, Space, Position, Information (TSPI)**							
11.1	Hyper Velocity TSPI							
11.2	Enhanced Translated GPS Instrumentation System							
11.4	High Volume Low Dynamic Tracking Capability							
11.5	Advanced Range Radar							
11.6	Airborne Position Location System							

b. Infrastructure Roadmap. The effort to sustain our ranges and our technological capabilities must be accomplished with an eye toward a cohesive, distributed end-state, the 21st Century Range. Just as the Army must recapitalize current systems that will continue to serve in the Future Force, the Army's core T&E infrastructure must also be sustained so it can continue to support the fielding of the Future Force.

In addition to the technology investment required to support the Army Transformation, a requirement exists to modernize the test infrastructure and to maintain and sustain both new and existing capabilities. The Test Technology roadmap previously presented in this chapter reflects the T&E technology investments required to support Army Transformation. While they represent the basic resource requirements to develop the capability, they do not reflect the full resource requirements to bring the capability on line nor any of the resource requirements to maintain the capability.

To the extent that these new capabilities represent net additions to the instrumentation inventory, a corresponding increase must be allocated to the institutional accounts. These accounts are responsible for maintaining the capability in a ready-for-test condition along with the entire pre-existing instrumentation inventory needed to support other portions of the Army Transformation Program.

To bring the expanded test capabilities on line will frequently require the extension of utilities service into new areas of ranges. Hardstands, shelters, and paved access to new and/or current range sites are required to protect sensitive instrumentation systems from the environment. Helicopter hangers, Environmental Protection Agency (EPA) compliant equipment, upgraded instrumentation for existing indirect fire test facilities and impact areas, and expanded facilities for sophisticated smart weapons, are but a few examples of the types of infrastructure upgrades that will be required. Unless the new investments displace pre-existing instrumentation sets, new structures or mobile platforms will be required to house them. Even when pre-existing instrumentation sets are displaced or replaced, the supporting structures will frequently have to be internally modified to accommodate the new equipment sets. The basic development requirements identified within the ATRMP's 11

Technology Area roadmaps do not include the construction, extension, or modifications required to bring the new capabilities on line. This must be borne by the mission overhead accounts of the ranges or in some instances, Military Construction, Army (MCA) projects.

In summary, sustaining the Army's core T&E infrastructure has been considered a deferrable expense during the past decade. During this time, not only has the capability degraded through normal wear and tear, but also many technological advances occurring during that period have been missed. Army Transformation provides a blueprint for a new military hardware deployment and operating scheme. Recognizing that the situation described above cannot be rectified in a single year, commands must develop and forward an executable plan that provides over time, a percentage increase in investment funding to ensure that our infrastructure and instrumentation are sustained and modernized. The infrastructure roadmap, shown below, highlights programs that maintain the Army's T&E infrastructure. The program names are listed on the left. The years a program requires modernization/sustainment funding are indicated in solid gray. These requirements should be considered during planning of the FY 07-11 POM.

Infrastructure Roadmap

Ref No.		FY05	FY06	FY07	FY08	FY09	FY10	FY11
12.0	**Modernization**							
12.1	MPE - MOD Mulberry Point Enhancement-ATC	■	■	■				
12.2	Spectral Characterization of Thermal Imagers-ATC	■						
12.3	Mulberry Point Upgrade Modernization-ATC	■		■				
12.4	AA5 Live Fire Range Upgrade -ATC				■	■		
12.5	Trunked Radio System Modernization-ATC				■	■		
12.6	Fire Power Modernization-ATC				■	■	■	■
12.7	Offsite Test Support Shelter-ATTC		■					
12.8	Redstone Army Airfield Temp Maintenance Facility-ATTC		■					
12.9	M&S Work Area Upgrade-ATTC	■	■					
12.10	Instrumentation Workspace Upgrade-ATTC	■	■					
12.11	Aircraft Hangar Upgrades-ATTC			■	■			
12.12	M&S Laboratory Upgrade-ATTC					■		
12.13	General Infrastructure Modernization-RTTC	■	■	■	■	■	■	
12.14	Trunked Radio System-RTTC	■	■	■	■			
12.15	Static Test Facility & Equipment Modernization -RTTC				■	■	■	

Infrastructure Roadmap

Ref No.		FY05	FY06	FY07	FY08	FY09	FY10	FY11
12.16	Laboratory Infrastructure Modernization-RTTC							
12.17	Range Test Modernization -RTTC							
12.18	Static Test Stands & Roads Modernization -RTTC							
12.19	National Range Operations Facilities Mod-WSMR							
12.20	Systems T&A Test Facility SRM Mods - WSMR							
12.21	Five Year Communications Plan -WSMR							
12.22	Applied Sciences Division Instru Mod - WSMR							
12.23	EPG Test Facilities Modernization-EPG							
12.24	TSN Huachuca -EPG							
12.25	Rough Handling / Shock Facility Upgrade -YPG							
12.26	Climatic Test Facility Control Room Upgrade -YPG							
12.27	Hard Power to GPs-YPG							
12.28	Covered Communications Equipment Storage -YPG							
12.29	GP-17A Target System Upgrade-YPG							
12.30	B2096 Replacement / Enhancement - YPG							
12.31	FCS (MTHEL/EAADs Variant) Hazardous Test Area - HELSTF							
12.32	Selective Demolition Kwaj, Roi and Meck - RTS							
12.33	Incinerator Replacement - RTS							
12.34	Replacement of Dining Facility - RTS							
12.35	Multi-Purpose Complex - RTS							
12.36	Repair Echo Pier – RTS							
12.37	Child Care Center - RTS							
12.38	Kwaj Lodge - RTS							
12.39	Replace Aviation Terminal - RTS							
12.40	Hospital Addition and Repairs - RTS							
12.41	Installation of Fire Suppression Systems on Roi and Kwajalein - RTS							
12.42	Repair Bucholz Army Air Field (Kwajalein) - RTS							
12.43	Roi Namur Pier and Ramp - RTS							
12.44	Pier and Ramp Repair on Outer Islands - RTS							
12.45	Ordnance Storage Facility - RTS							
12.46	General Purpose Storage Facility – Kwajalein - RTS							
12.47	Trailer Replacement - RTS							
12.48	Waste/Water Treatment Plant Repair/Upgrades - RTS							
12.49	Engine Generator Replacement – Meck -							

Infrastructure Roadmap

Ref No.		FY05	FY06	FY07	FY08	FY09	FY10	FY11
	RTS							
12.50	Consolidate Maintenance Facilities - RTS							
12.51	Commissary (Non-DeCA) - RTS							
12.52	Hazardous Material Storage - RTS							
12.53	Meteorological Facility - RTS							
12.54	Fire Station – Kwajalein - RTS							
12.55	Outer Island Power Plants - RTS							
12.56	Automotive Maintenance Facilities - RTS							
12.57	Helicopter Hangar – Kwajalein - RTS							
13.0	**Sustainment**							
13.1	*General Test Instrumentation*							
13.1.1	- Radar							
13.1.2	- GPS							
13.1.3	- Telemetry							
13.1.4	- Computer Replacement / Upgrades							
13.1.5	- Storage Upgrades							
13.1.6	- Communications							
13.1.7	- Sensors							
13.1.8	- Transducers							
13.1.9	- Calibration							
13.1.10	- Climatic							
13.1.11	- Shock & Vibration							
13.2	Facilities BMAR - HELSTF							
13.3	Core Infrastructure BMAR - HELSTF							
13.4	ALTAIR Antenna Hardware - RTS							
13.5	Airfield Maintenance - RTS							
13.6	Shore Protection - Kwajalein and Roi-Namur - RTS							
13.7	Core Infrastructure BMAR - USAKA/RTS							
13.8	Navy Housing Revitalization - RTS							
13.9	Townhouse Renovation - Kwajalein North Point - RTS							

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Chapter VI. General Implementation Guidance for the T&E Investment Strategy

A. Purpose and Goal

General guidance is provided below to direct the planning of the TST BOS investments that best support the Army Modernization Strategy in concert with the T&E infrastructure vision, objectives and strategy. The result will be the FY07-11 TST BOS POM. Detailed specific guidance will be provided through briefings and email.

B. Priorities

In the absence of additional guidance from the Army staff, general investment guidance for building of the FY07-11 TST BOS POM follows the guidance prescribed in the Army Modernization Plan. *The number one priority for Army investments is the development of the FCS.*

Each command and organization in the TST BOS will build its program using the following *general* priority scheme:

1. Fund all system-related requirements supporting the FCS, to include technology insertions.
2. Fund all system-related requirements supporting the remaining Future Force systems.
3. Fund all system-related requirements supporting the Current Force, to include modernization/recapitalization.
4. Fund all system-related requirements supporting the remaining Current Force systems.

C. Requirements and Risk Definitions

Typically all requirements are captured in a POM build. The following definitions for requirements and risk will be used by the TST BOS commands and organizations in the development of their programs.

- *Critical* is a requirements level such that any funding less than this level questions the ability that Transformation can be executed at all. This level presents **maximum** risk to Transformation execution and provides resources to execute a program at the minimum capability. If your organization cannot fund to this level then a Band 1 Unfinanced Requirement (UFR) is created. The presence of a Band One UFR implies

that we cannot support Transformation. That is, you are telling the Chief of Staff of the Army that unless this is funded, either the Transformation requirement must be changed or funding must be found.

- *Validated* is a requirements level that satisfies the Transformation requirements without major degradation and thus presents **minimum** risk to Transformation execution. If your organization cannot fund to this level then a Band 2 UFR is created.

- *Requested* requirements identify all remaining portions of the total requirement of a program assuming unconstrained resources and thus present **no** risk.

For each applicable PE, the TST BOS organization will develop a "1-N" list of required programs/projects/items at each requirements level. This should be developed at the lowest level possible within the PE (i.e., at the individual task level within each project if possible).

Requirements that fall within your available funding will be considered higher priority than any program or project unfunded. Consequently, requirements submitted with a "must fund" rationale must also include thorough justification explaining why another program or project previously funded within the submitting organization's TOA cannot be unfunded.

D. Additional General Guidance

All statutory requirements (e.g., Title X United States Code) will be funded.

All personnel authorizations will be funded to meet critical workload requirements.

Congressional items of interest, Program Decision Memoranda, Program Budget Decisions and other adjustments will be addressed in order to forestall decrements in future program and budget reviews.

Environmental management costs, including remediation of all Class I environmental hazards, must be fully identified and funded.

Funding needed for the completion or continuance of an on-going project or program should be continued. Once the decision is made to invest in a project/program we will follow through on the commitment unless there is a logical reason not to do so.

E. Conclusion

The strategy upon which the ATRMP is based strives to maintain the T&E infrastructure that has served the Army well in recent acquisition programs. The strategy also recognizes that although outside factors have deferred previously planned modernization efforts, there is an opportunity through unity of effort to prudently focus our resources. The ATRMP provides guidance to the T&E community for resource planning and a justification and explanation of T&E resource needs to outside entities.

Our four goals: Maintaining the Workforce, Developing Advanced Capabilities, Integrating SBA, and Modernizing our Core Infrastructure, allow us to channel our investments in support of the Army Modernization Plan. Our management initiatives will continue to evolve the content and structure of our community to better position us to support the Army's changing needs. An approved community-wide strategy for investment, linked to and supportive of the Army's Modernization Strategy, will enable us to better defend our resource requirements.

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GLOSSARY

AAA	Anti-aircraft Artillery
A2C2S	Army Airborne Command and Control System
ABCS	Army Battle Command System
ABNSOTD	Airborne and Special Operations Test Directorate
ACAT	Acquisition Category
ACS	Aerial Common Sensor
ACTD	Advanced Concept Technology Demonstration
ACUS	Army Common User System
ADA	Air Defense Artillery
ADATD	Air Defense Artillery Test Directorate
ADPE	Automated Data Processing Equipment
AEC	Army Evaluation Center
AFATDS	Advanced Field Artillery Tactical Data System
AIS	Automated Information System
AMC	Army Materiel Command
AMDCCS	Air and Missile Defense Command & Control System
AMDED	Air and Missile Defense Evaluation Directorate
AMMPS	Advanced Medium Mobile Power Source
AMP	Army Modernization Plan
AMSAA	Army Materiel Systems Analysis Activity
AMSCA	ATEC Mission Support Contracting Activity
AMSSTC	Advanced Multi-spectral Sensor and Subsystem Test Capability
AMSTAR	Advanced Multi-spectral Simulation, Test, Acceptance Resource
AMX	Army Model Exchange
APKWS	Advanced Precision Kill Weapon System
AoA	Analysis of Alternatives
ARL	Army Research Laboratory
ARNG	Army National Guard
ASA(ALT)	Assistant Secretary of the Army, Acquisition, Logistics, Technology
ASAS	All Source Analysis System
ASLMS	Authorized Stockage List Mobility System
ASTMP	Army Science and Technology Master Plan
ATACMS	Army Tactical Missile System
ATC	Aberdeen Test Center
ATD	Advanced Technology Demonstration
ATDL	Advanced/Army Tactical Data Link
ATEC	Army Test and Evaluation Command
ATGM	Antitank Guided Missile
ATIN	ATEC Test Integration Network
ATIP	Advanced Technology Investigation Process

ATIRCM	Advanced Threat Infrared Countermeasures
ATNAVICS	Air Traffic Navigation, Integration, and Coordination System
ATRMP	Army Test Resources Master Plan
ATSA	ATEC Threat Support Activity
ATTC	Aviation Technical Test Center
ATTIC	Army Test and Training Investments Conference
ATTRO	Army Test and Training Requirements Online
AVED	Aviation Evaluation Directorate
AVTD	Aviation Test Directorate
AWE	Advanced Warfighting Experiment
BA	Battlespace Awareness
BCS3	Battle Command Sustainment Support System
BCS	Battery Computer System
BIDS	Biological Integrated Detection System
BLOS	Beyond line of sight
BOS	Budget Operating System
BRAT	Beyond Line-of-Sight Reporting and Tracking
C2	Command and Control
C3	Command, Control and Communications
C3ED	Command, Control, and Communications Evaluation Directorate
C4I	Command, Control, Communications, Computers and Intelligence
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
C4TD	Command, Control, Communications, and Computers Test Directorate
CAISI	Combat Service Support Automated Information System Interface
CAMEL	Unit Water Pod System
CB	Chemical and Biological
CBPS	Chemical Biological Protective Shelter
CCED	Close Combat Evaluation Directorate
CCTD	Close Combat Test Directorate
CDD	Capability Development Document
CG	Commanding General
CKEM	Compact Kinetic Energy Missile
COIC	Critical Operational Issues and Criteria
CONUS	Continental United States
CPMEDS	Collectively Protected Deployable Medical System
CRTC	Cold Regions Test Center
CSA	Chief of Staff, Army
CSED	Combat Support Evaluation Directorate

CT	Customer Test
CTC	Combat Training Center
CTEIP	Central Test and Evaluation Investment Program
CV	Commander Vehicle
DA	Department of the Army
DCG	Deputy Commanding General
DCGS-A	Distributed Common Ground Station-Army
DE	Directed Energy
DEPMEDS	Deployable Medical Systems
DoD	Department of Defense
DODAF	DoD Architecture Framework
DoDD	Department of Defense Directive
DOTMLPF	Doctrine, organizations, training, materiel, leadership and education, personnel and facilities
DPG	Dugway Proving Ground
DSB	Dry Support Bridge
DT	Developmental Testing
DTC	Developmental Test Command
DT&E	Developmental Test and Evaluation
EAADS	Enhanced Area Air Defense System
E3	Electromagnetic Environmental Effects
ECSTD	Engineer and Combat Support Test Directorate
ENVG	Enhanced Night Vision Goggles
EPA	Environmental Protection Agency
EPG	Electronic Proving Ground
ESV	Engineer Squad Vehicle
EW	Electronic Warfare
EWVA	Electronic Warfare Vulnerability Analysis
ExCIS	Extensible C4I Instrumentation Suite
FA	Field Artillery
FBCB2	Force XXI Battle Command Brigade & Below
FCS	Future Combat Systems
FDTE	Force Development Testing and Experimentation
FEL	Free Electron Laser
FFED	Future Force/Transformation Evaluation Directorate
FFTD	Future Force Test Directorate
FMTV	Family of Medium Tactical Vehicles
FOS	Forward Observer System
FOT	Follow-on Test
FOTE	Follow-on Operational Test and Evaluation
FRS	Forward Repair System
FS	Fire Support
FSA	Fire Support Application

FSED	Fire Support Evaluation Directorate
FSTD	Fire Support Test Directorate
FSV	Fire Support Vehicle
FTTS	Future Tactical Truck System
FY	Fiscal Year
GATM	Global Air Traffic Management
GAVELS	Geometric Automated Video Enhanced Location System
GCCS-A	Global Command and Control System-Army
GCSS	Global Combat Service Support - Army
GMD	Ground-based Mid-course Missile Defense
GMLRS	Guided Multiple Launch Rocket System
GPS	Global Positioning System
GB	Grenadier BRAT
GSTAMIDS	Ground Standoff Minefield Detection System
GWoT	Global War on Terror
HEL	High Energy Laser
HELSTF	High Energy Laser Systems Test Facility
HEMP	High Altitude Electromagnetic Pulse
HEMTT	Heavy Expanded Mobility Tactical Truck
HIMARS	High Mobility Rocket System
HIPPO	Load Handling System (LHS) Compatible Water Tank Rack System
HMMWV	High Mobility Multi-Wheeled Vehicle
HPM	High Power Microwave
HQ	Headquarters
HSTAMIDS	Handheld Standoff Mine Detection System
HSTSS	Hardened Subminiature Telemetry and Sensor Suite
IADS	Integrated Air Defense System
IAW	In Accordance With
I&M	Improvement and Modernization
ICBM	Intercontinental Ballistic Missile
ICV	Infantry Carrier Vehicle
IED	Improvised Explosive Device
IED	Intelligence Evaluation Directorate
IEW	Intelligence & Electronic Warfare
IEWTD	Intelligence & Electronic Warfare Test Directorate
ILS	Integrated Logistics Support
IMASE	Intelligent Modeling & Simulation for Evaluation
IMETS	Integrated Meteorological System
IMO	Instrumentation Management Office
IO	Information Operations
IOC	Initial Operational Capability

IOT	Initial Operational Test
IOTE	Initial Operational Test and Evaluation
IP	Integrated Process
IPR	In-Process Review
IPT	Integrated Product Team
IR	Infrared
IRB	Improved Ribbon Bridge
IRCC	Inter-range Control Center
IRSS LFRA	Infrared Sensor Stimulator Large Format Resistive-emitter Array
ISR	Intelligence, Surveillance, and Reconnaissance
ISS	Instrumentation, Simulation, and Stimulation
ITED	Information Technology Evaluation Directorate
ITTS	Instrumentation, Targets, and Threat Simulators
IW	Information Warfare
JBAIDS	Joint Biological Agent Identification and Diagnostic System
JBSDS	Joint Biological Standoff Detection System
JCAD	Joint Chemical Agent Detector
JFC	Joint Forces Commander
JIM	Joint, Interagency, and Multi-National
JITC	Joint Interoperability Test Command
JLENS	Joint Land Attack Cruise Missile Defense Elevated Netted Sensor
JLIST	Joint Service Lightweight Integrated Suit Technology
JMPS	Joint Mission Planning System
JNTC	Joint National Training Center
JPALS	Joint Precision Approach Landing System
JPS	Joint Portal Shield
JSFDS	Joint Service Family of Decontamination Systems
JSLNBCRS	Joint Service Lightweight NBC Recon System
JSLSCAD	Joint Service Lightweight Standoff Chemical Agent Detector
JSSED	Joint Service Sensitive Equipment Decontamination
JT	Joint Test
JT&E	Joint Test and Evaluation
JTAGS	Joint Tactical Ground Station
JTRS	Joint Tactical Radio System
JTTRR	Joint Test and Training Range Roadmap
JWARN	Joint Warning & Reporting Network
KMR	Kwajalein Missile Range
KTM	Kineto Tracking Mounts
LAN	Local Area Network

LFT&E	Live Fire Test and Evaluation
LHS	Load Handling System
LMFF	Load Handling System Modular Fuel Farm
LNO	Liaison Office
LOSAT	Line-of-sight Anti-tank
LRAS3	Long Range Advanced Scout Surveillance System
LRIP	Low-rate Initial Production
LUT	Limited User Test
LWP	Lightweight Water Purifier
M3P	Multi-mission Mobile Processor
M&S	Modeling and Simulation
MC	Mortar Carrier
MCA	Military Construction, Army
MC4	Medical Communications for Combat Casualty Care
MCS	Maneuver Control System
MDA	Missile Defense Agency
MDAP	Major Defense Acquisition Program
MDEP	Management Decision Packages
MDTS	Multimedia Data Transfer System
MEADS	Medium Extended Air Defense System
MEV	Medical Evacuation Vehicle
MGS	Mobile Gun System
MLRS	Multiple Launch Rocket System
MOSAIC	Multi-Functional On-the-Move Secure Adaptive Integrated Communications
MOTE	Multi-Service OT&E
MOTS	Mobile Tower System
MRM	Mid-range Munition
MRTFB	Major Range and Test Facility Base
MSD	Maintenance Support Device
MTHEL	Mobile Tactical High Energy Laser
MTRS	Man-transportable Robotic System
MTS	Movement Tracking System
MTX	Mini Transmitter
MWSS	Mounted Warrior Soldier System
NASA	National Aeronautics and Space Administration
NBC	Nuclear, Biological and Chemical
NBCRS	Nuclear, Biological and Chemical Reconnaissance System
NBCRV	Nuclear, Biological, & Chemical Recon Vehicle
NFI	Non-invasive Filler Identification
NLCS	Non-lethal Capabilities Set
NLOS-LS	Non-Line-of-Sight Launcher System
NMD	National Missile Defense

O&M	Operations and Maintenance
O&O	Operational and Organizational
OASIS	OTC Analytic Simulation and Instrumentation Suite
OCSW	Objective Crew Served Weapon
OMA	Operations and Maintenance, Army
OMB	Office of Management and Budget
One-SAF	One Semi-Automated Forces
OSD	Office of the Secretary of Defense
OT	Operational Testing
OTC	Operational Test Command
OT&E	Operational Test and Evaluation
OT-TES	Operational Test - Tactical Engagement System
OV	Operational Views
P3I	Pre-Planned Product Improvement
PAC3	Patriot Advanced Capability 3
PE	Program Element
PEG	Program Evaluation Group
PEGASYS	Precision, Extended Glide Airdrop System
PEO	Program Executive Office(r)
PGMM	Precision Guided Mortar Munition
PLS	Palletized Load System
PM	Program Manager, Project Manager, or Product Manager
PM ITTS	Project Manager, Instrumentation, Targets and Threat Simulators
PoF	Physics of Failure
POM	Program Objective Memorandum
PPBES	Planning, Programming, Budgeting, and Execution System
R&M	Reliability and Maintainability
RAM	Reliability, Availability, and Maintainability
RAM	Rocket, Artillery and Mortar
RDA	Research, Development and Acquisition
RDECOM	Research, Development, and Engineering Command
RDT&E	Research, Development, Test and Evaluation
REBS	Rapidly Emplaced Bridge System
REF	Rapid Equipping Force
RF	Radio Frequency
RGB	Red-Green-Blue
RMS	Rapid Manufacturing System
RTCA	Real Time Casualty Assessment
RTCH	Rough Terrain Container Handler
RTS	Reagan Test Site

RTTC	Redstone Technical Test Center
RV	Reconnaissance Vehicle
SA	System Assessment
SAM	Surface to Air Missile
S&T	Science and Technology
SBA	Simulation-Based Acquisition
SBCT	Stryker Brigade Combat Team
SCIF	Sensitive Compartmented Information Facility
SDS	Sorbent Decontamination System, M100
SED	Survivability Evaluation Directorate
SEMA	Special Electronic Mission Aircraft
SER	System Evaluation Report
SIIRCM	Suite of Integrated Infrared Countermeasures
SINCGARS	Single Channel Ground and Airborne Radio System
SIRFC	Suite of Integrated Radio Frequency Countermeasures
SLAD	Survivability, Lethality, and Analysis Directorate
SL-AMRAAM	Surface Launched Advanced Medium Range Air-to-Air Missile
SLBD	Sea Lite Beam Director
SLV	Survivability, Lethality, and Vulnerability
SMART	Simulation and Modeling Acquisition, Requirements, and Training
SMART-T	Secure Mobile Anti-jam Reliable Tactical Terminal
SMDC	Space and Missile Defense Command
STORM	Simulation Testing Operations Rehearsal Model
STRI	Simulation, Training, Instrumentation
SV	System View
T3I	Test, Training and Technology Integration
TADIL	Tactical Digital Information Link
T&E	Test and Evaluation
TAIS	Tactical Airspace Integration System
TC-AIMS	Transportation Coordinators' - Automated Information for Movement System
TCP	Transformation Campaign Plan
TECO	Test and Evaluation Coordination Office
TEMA	Test and Evaluation Management Agency
TEMP	Test and Evaluation Master Plan
TENA	Test and Training Enabling Architecture
TES	Tactical Exploitation System
TESS	Tactical Engagement Simulation System
TESA	Test and Evaluation Support Activity
THAAD	Theater High Altitude Area Defense
THEL	Tactical High Energy Laser

TIBS	Tactical Information Broadcast System
TMD	Theater Missile Defense
TMO	Targets Management Office
TQG	Tactical Quiet Generator
TRADOC	Training and Doctrine Command
TRAG	Test Resource Advisory Group
TRTC	Tropic Regions Test Center
TSMO	Threat Systems Management Office
TSPI	Time-Space-Position Information
TSPP	Threat Simulator/Simulation Program Plan
TST BOS	Test Budget Operating System
TSV	Theater Support Vessel
TTP	Tactics, Techniques, and Procedures
TUAV	Tactical Unmanned Aerial Vehicle
TV	Technical View
TWS	Thermal Weapons Sights
UAV	Unmanned Aerial Vehicle
UFR	Unfinanced Requirement
USAKA	US Army Kwajalein Atoll
USAR	United States Army Reserve
USASMDC	US Army Space and Missile Defense Command
USC	United States Code
UTM	Universal Transverse Mercator
UV	Ultraviolet
VPG	Virtual Proving Ground
VV&A	Verification, Validation, and Accreditation
WIN-T	Warfighter Information Network-Tactical
WSMR	White Sands Missile Range
YPG	Yuma Proving Ground

Inquiries may be addressed to:

HQDA
Office of the Chief of Staff of the Army
US Army Test & Evaluation Management Agency
ATTN: DACS-TE, Room 2C139A
200 Army Pentagon
Washington, D.C. 20310-0200

Telephone: (703) 695-8995; (703) 695-7395
E-mail: Rex.Huling@hqda.army.mil

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